PROFESSIONAL DEVELOPMENT EFFECTS ON TEACHERS' SELF-REGULATED LEARNING

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ABSTRACT

"New pedagogies" (Fullan, 2013) require that teachers and leaders of learning develop a cadre of efficient strategies for helping students learn by applying best practices from the learning sciences to the professional practices of educators. Providing learners with meaningful opportunities that support the acquisition of deeper learning skills requires instructional leaders to support educators in refining their practices. New pedagogy, however, requires new ways of thinking about training, and development both in policy and in practice. In order to move students and teachers into an innovation economy that posits thinking skills at the core of curriculum, instruction, and assessment, outdated methods of instructionism (Sawyer, 2006) that prepared students for an industrial economy must be replaced with opportunities to think critically, collaborate, communicate and create. Given the changes in our global and local economy, as well as the diversity of skills needed to be college and career ready, effective instructional leadership is identified as a prerequisite to supporting new teaching strategies. The following dissertation takes up issues around the misalignment between teacher development and "21st century" learning skills. A social-cognitive framework is applied to think through this problem of practice unique to twenty-first century communities of learning. Key issues in teacher development such as the transfer of learning are addressed through a professional development model, designed by the student investigator, with the aim of improving self-regulated learning outcomes for students and teachers alike. The professional development sequence involved training educators in an evidence-based framework based in principles of neuroscience called Universal Design for Learning (CAST) and supported them with implementation through a goal-directed lesson study aimed to support adjustments to instructional practice. A mixed methods approach was used to assess the efficacy of the intervention. Positive results were identified and led to the conclusion that a goal-directed professional development sequence does support the self-regulated learning of teachers and also leads to adjustments in instructional practice.

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Chapter One

Executive Summary

Today's learners are being prepared for jobs that do not yet exist (Zhao, 2013). Our nation's learners need to be flexible thinkers who can participate in an innovation economy (Sawyer, 2006). Knowing what to do with one's knowledge and how to create new knowledge (Wagner, 2012) is a key outcome of deeper learning in the 21st century. Deep learning is about addressing real problems, intellectual-risk taking, trial and error problem-solving, collaboration in learning, and intrinsic motivation (Fullan, 2013). In order to engage in these higher-order systems of thinking, however, students rely on their executive functioning skills (Pellegrino & Hilton, 2013). To be more specific, self-regulation is one of the most critical executive functions. Self-regulated learning (SRL) is a critical skill in pre-schools through post-secondary settings. Sadly, however, many teachers report low levels of self-efficacy when it comes to building their students' capacity for SRL, leaving our nation's pre-service and in-service teachers underprepared to meet the needs of their students.

Recent federal reform efforts such as No Child Left Behind (NCLB), Race to the Top (RTTT), and the Every Student Succeeds Act (ESSA), the implementation of the Common Core State Standards (CCSS) and national assessments such as Smarter Balanced and the Partnership for the Assessment of Readiness for College and Careers (PARCC), combined with changes in state and district mandates have left our nation's teachers and principals in the difficult position of struggling to maintain compliance. In an era of education where the stakes remain high and the demands of educators seem greater every day, highly effective instructional leadership is the key to the success of our teachers and our students. However, school-based professional development often fails to

align teacher learning needs, with federal and local mandates, and what has come to be known as "best practice."

For the purpose of this study, needs were assessed in a middle-income elementary school outside of Boston, Massachusetts (the same site where the intervention was implemented). In assessing the needs of teachers within the target population, the following aims were developed: (a) to examine teacher perceptions about their level of preparedness in designing instruction within the school's curriculum and (b) to determine how current professional development practices do/do not support teachers' observed instructional approaches. The following research questions were developed to guide the study: (a) what are teachers' self-reports of using evidence-based strategies in their current instructional practices? (b) how do teachers' self-efficacy beliefs change after the course of a professional development sequence? (c) does a SMART goal driven model lead to adjustments in instructional practice? (d) how does lesson study promote the self-regulated learning of teachers?

After an initial review of the school's data, discrepancies were found between the number of students identified in the Response to Intervention (RtI) program struggling with EF and the number of teachers who self-reported high levels of efficacy in addressing SRL and goal-directed behavior. This led to further investigation of instructional practice as well as professional development practices. According to the MA TELLS (2014) report, teachers within the target population reported low levels of efficacy in meeting the individual needs of learners. Likewise, they articulated professional development needs in heightening the salience of goals and objectives,

maximizing transfer and generalization, guiding appropriate goal-setting, and supporting planning and strategy development.

In order to address the individual needs of teachers at the study site, a professional development sequence was designed by the school's principal in order to align school-based professional development with teacher SMART professional practice and student learning goals, self-regulate the instructional skills of teachers, and increase teachers' feelings of efficacy in meeting the needs of individual learners. The professional development sequence included 375 minutes devoted to the study and application of Universal Design for Learning (UDL) principles of Multiple Means of Engagement (MME), 585 minutes of training, planning, teaching, and reflection on the lesson study process, and 610 minutes of training, planning, and reflection on how to meet the individual needs of learners using a tiered instructional approach.

A mixed methods approach was used to assess the participants' levels of efficacy and observed adjustments to instructional practice. Participants engaged in an interrupted time series of pre and post assessments prior to the intervention as well as after the intervention. Participants also joined in focus groups after the intervention was complete and instructional practices were observed using a measure designed by the student investigator to assess the presence of UDL features in observed instructional practice.

Findings showed that a goal-driven professional development model leads to adjustments in instructional practice and the self-regulation of teachers' instructional skills. Likewise, participants self-reported higher levels of self-efficacy after the intervention was complete. In particular, participants reported high levels of self-efficacy with regard to designing instruction that supports multiple means of engagement. This

was an anticipated outcome. Lesson plans and observations showed that participants made adjustments to practice using the UDL framework. Learning transfer and generalization was also an area where participants reported higher-levels of self-efficacy post-intervention. This finding may warrant future study. The greatest limitation posed by this study was time. Participants reported that they needed several more hours of professional development in UDL in order to achieve mastery.

Chapter Two

Overview of the Problem of Practice

Overview of the Problem of Practice (POP) and Driving Factors

Teachers are not prepared to meet the needs of today's learners (Center for Public Education, 2013). Factors associated with this problem include inadequate teacher preparation, a deluge of recent reform efforts, and lack of instructional leadership from principals (Wallace Foundation, 2013). Teachers often report that building and district-level professional development does not address their unique learning needs, and also report low levels of efficacy in meeting the unique needs of variable learners in their classrooms (MA TELLS, 2014). For the purpose of this study, the scope of this problem will focus on the examination of teacher's perceptions of their learning from professional development.

Review of the Literature on Underlying Causes and Factors Related to the POP

Although there is deliberation about how to improve teaching and learning in our nation's classrooms, the time for change is now. "New pedagogies" (Fullan, 2013) require that teachers develop a cadre of efficient strategies for helping students learn by incorporating brain research and developments in the field of cognitive psychology into their professional practice. If we want to provide students with meaningful and engaged opportunities for learning that support the acquisition of deeper learning skills, we must support teachers in refining their instructional practices. New pedagogy, however, requires new ways of thinking about teacher professional development.

Competencies for Today's Learners. While some educators (Fullan, 2013) agree that learning as defined in the last few decades involves a new system of pedagogy, and that student achievement can be raised through effective implementation of curriculum, there are varied opinions and even greater debate about the instructional

practices that will provide students with the competencies needed to master core academic content. The new model for educating young people is predicated on the idea that "learning should be driven by a focus on students and their proficiency with specific competencies, and not by archaic school structures and arbitrary, age-based benchmarks" (Moeller & Reitzes, 2011, p. 9). Likewise, cognitive skills such as executive functioning should form the basis of the new pedagogy. The ability to self-regulate one's learning ranks among the most integral of these executive functions.

As the demands of the labor market continue to change, and as we learn more about how the brain learns, new instructional practices are needed. The Common Core State Standards (CCSS), for example, were developed in response to the belief that change was necessary in order to promote future labor market success. As the skills children need in order to become "college and career" ready change, teachers need to develop a deeper understanding of the learning process and, therefore, "teachers' long term productivity will more critically depend on their ability (and that of higher education) to create a new institutional model of teaching and learning that will bolster their competence and increase their autonomy" (Meyer, 2006, p. 221). While the debate over learning continues to play out in the arena of educational policy (Weeres and Kerchner, 1996), schools are doing the best they can to keep pace with the number of federal and state policy initiatives by implementing new standards, new assessments, and new systems to monitor educator quality.

According to the United States Bureau of Labor Statistics, 53% of college graduates remain jobless and there is a growing body of educators who believe this is because few schools are preparing students for a global economy that requires

innovation, creativity, and complex problem-solving (Zhao, 2013). The nation-wide shift to the CCSS reflects the need to improve student learning outcomes and shift our focus towards mastery of cognitive skills at chronological age-based benchmarks, but it is not simply the curriculum that needs attention. It is the instructional practices of teachers that require real change (Fullan, 2013).

At present, we live in a "knowledge economy" where the "memorization of facts and procedures is not enough for success [and] educated graduates need a deep conceptual understanding of complex concepts, and the ability to work with them creatively to generate new ideas, new theories, new products, and new knowledge" (Sawyer, 2006). In order to move students and teachers into an innovation economy that posits thinking skills at the core of curriculum, instruction, and assessment, schools should consider replacing outdated methods of instructionism that prepared students for an industrial economy (Sawyer, 2006) with opportunities to think critically, collaborate, communicate and create (www.p21.org). Despite the changes in our global economy, and the diversity of skills needed to be college and career ready, teacher preparation has not changed significantly since the turn of the twentieth century. Teacher preparation in the United States has changed little over the last hundred years.

The National Research Council (2013) outlined three domains of competence for the 21st century: cognitive, inter-personal, and intra-personal. In identifying these three domains, the research team drew two major conclusions from their research: "cognitive competencies have been more extensively studied than have interpersonal and intrapersonal competencies, sharing consistent, positive correlations (of modest size) with desirable educational, career, and health outcomes" and that "among intrapersonal and

interpersonal competencies, conscientiousness (staying organized, responsible, and hardworking) is most highly correlated with desirable educational, career, and health outcomes" (Pellegrino & Hilton, 2013, p. 33). Among these cognitive competencies are: cognitive processes and strategies (fluid intelligence), knowledge (crystallized intelligence), and creativity (general retrieval ability) (Pellegrino & Hilton, 2013). Among the intrapersonal competencies are: intellectual openness (openness), work ethic (conscientiousness), and positive core self-evaluation (emotional stability) (Pellegrino & Hilton, 2013). And among the interpersonal competencies are: teamwork and collaboration (agreeableness) and leadership (extroversion) (Pellegrino & Hilton, 2013). Across these broad categories of skills and clusters, executive skills such as initiative, self-direction, self-regulation, flexibility, adaptability, and self-reflection emerge (Pellegrino & Hilton, 2013). If one had to prioritize instructional needs based on this study, it would be clear that teachers must find ways to build students' executive functioning skills as they prepare learners for colleges and careers. In turning our attention to competencies before curriculum, we need to assist teachers in building their self-core evaluations of executive skills such as self-regulated learning.

Learning happens in the architecture of the mind and understanding how synaptic activation occurs helps us better appreciate intelligence, communication, curiosity, and problem solving (Dubinsky, Roehrig, & Varma, 2013). Likewise, learning must be situated in a given context in order to make meaning. To "know" something means that the learner is involved in that knowing, that the learner adopts tools, interacts with other people in the environment, and applies her understanding to novel contexts (Sawyer, 2006). Knowing what you know is less important than knowing what to do with one's

knowledge and creating new knowledge is the intended outcome of 21st century learning (Wagner, 2012). Deep learning is about addressing real problems, intellectual risk-taking and trial and error problem-solving, collaboration in learning, and intrinsic motivation (Fullan, 2013).

Preparation of In-service and Pre-service teachers. Before we can transform instructional practice, the first step is to develop teachers' knowledge about new theories of learning. New learning paradigms situate the classroom as a space where learning is emphasized over teaching, where students take an active role in their learning, where teaching is not done to people, but, rather learning is done by people (Prensky, 2012). Starting with the idea that learners are "active processors of information" (Bruning, Schraw & Norby, 2011) and that "intelligent behavior is based on representations in the mind" or "knowledge structures. . . such as concepts, beliefs, facts, procedures, and models" (Sawyer, 2006), understanding how to apply theories of learning in the classroom is crucial. Understanding the development of cognitive skills is integral for those who wish to design meaningful contexts for learning.

By changing the way instruction is delivered in the classroom, we can effect the way students learn. But reforming teacher preparation programs is not enough. Instead, we need to offer in-service teachers with professional development that provides them with the tools they need to meet the needs of all learners in a new era for teaching and learning. While "21st century learning" is a goal for schools across the nation, most fall short in facilitating the development of critical cognitive skills that will support a new generation of learners (Pellegrino & Hilton, 2012). Among the factors that drive this

problem, teacher innovation, lack of autonomy, and self-regulated learning are primary concerns (Moeller & Reitzes, 2011; Toussi & Ghanizadeh, 2012).

Education Reform in the United States and Challenges in Instructional Leadership. To be an educator in today's political climate is to live in an era of high-stakes accountability, standards, and ever-changing reform. In the United States, we recognize the necessity to reform education. Pundits and policy-makers from the far right and left acknowledge this need. Recent changes to federal policy, such as the signing of the Every Student Succeeds Act (ESSA) in December of 2015 provides further evidence to change how we serve children in public schools across the country. Our nation's schools need more than aspirational bills, however, that seek to place federal mandates on schools performing in the bottom 5%. Supporting the work of school leaders and classroom teachers in preparing students for today's world starts with transforming the ways in which we prepare instructional leaders for the principalship and how we support principals in their work with teachers.

As a reform policy, Race to the Top (RTTT) failed to address how to transform teaching in today's classrooms, and did little to support the work of teachers or instructional leaders, in spite of its claim to support "innovation" in schools. The policy is closely tied to achievement testing which is only one measure of student learning (and it should be noted how vehemently opposed educators across the nation are to the Smarter Balanced and Partnership for Assessment of Readiness for College and Careers (PARCC) assessments). Likewise, the policy did little to acknowledge the role of the principal in carrying out school reform efforts. Although research suggests that the classroom teacher has the greatest impact on student learning, school principals are the second most

influential in improving student achievement (Wallace Foundation, 2013). In underperforming "turnaround" schools, the principal is the first employee to be removed and yet there is little support provided to new turnaround principals and even fewer regulations governing the qualifications for them.

The United States Congress recently passed the Every Student Succeeds Act (ESSA) in December 2015 which claims to "reaffirm that fundamentally American ideal – that every child, regardless of race, income, background, [and] zip code . . . deserves the chance to make of their lives what they will" (Obama, 2015). In his address to the public about the bill, President Obama spoke highly of this "bipartisan effort" to improve education. While the bill is intended to provide states with more autonomy in governing and deciding the bill's implementation, it does little to address the crucial role of principal preparation, or support principals in their work with teachers. Such variability in the preparation of principals leads to variability in their professional development practices. The bill supports merit-based compensatory systems but this is putting the proverbial cart before the horse. First, merit-based systems have not been proven to be effective and second, compensating principals for boosting student achievement builds on a dangerous assumption that principals already have all of the resources that they need to increase student achievement.

The Interstate School Leaders Licensure Consortium (ISLLC) articulated six competencies for school principals in order to provide states with guidance in preparing them for the field: (a) vision; (b) school culture and instructional program; (c) management; (d) community and families; (e) ethical behavior; and (f) context: political, social, economic, and legal (2014). The intent in publishing these standards was to

articulate the competencies that lead to the state licensure of school principals. According to the National Conference of State Legislatures (2015), 40 states adopted these standards, mandating that principals seeking certification through field and course work demonstrate these competencies in a number of ways. Some states require that principals not only conduct coursework aligned with the standards, as well as field placements where they must demonstrate competencies aligned with them but also a national licensure examination aligned to the standards. The exam, called the School Leadership Series, is monitored, assessed, and administered by the Educational Testing Service (ETS). While these standards provide a framework for the professional practices of principals, they fail to acknowledge the integral nature of the principal as an instructional leader.

Through their study of scholarship among effective principals, the Wallace Foundation (2013) identified five practices that school principals do well: (a) shape a vision of academic success for all students; (b) create a climate hospitable to education; (c) cultivate leadership in others; (d) improve instruction; and (e) manage people, data and processes to foster school improvement. The Wallace Foundation's report builds on the standards articulated by the Council of Chief State School Officers and does more to recognize the need for leadership in schools. While principals do need procedural knowledge in how to effectively manage employees, resources, and systems, it takes leadership to build the conditions for schools that support high levels of achievement and engagement with each of the school's stakeholders that leadership is demonstrated through the strategic planning of professional development.

We can not wait for the political process to take care of the current situation (Bardach, 2012) nor can we continue to operate under the false assumption that the conditions for principals support instructional leadership. As the Wallace Report (2013) points out, instructional leadership should be the highest priority of principals and yet ESSA, Race To The Top, or the Interstate School Leaders Licensure Consortium (ISLLC) standards do not recognize it as such. Instead, competitive funding for "innovation" in schools is channeled through superintendents and through state departments of education. Though principals are key stakeholders in leading innovative practices as well as implementing reform, they are often left out of the process. While superintendents theoretically sit at the top of the organizational pyramids in local districts, it is generally the building principal who is responsible for training, coaching, and supporting teachers in classrooms.

Social Contexts for Learning. Cognitive engagement requires that learning be a social process. For children, "every function in the child's cultural development appears twice: first on the social level, and later, on the individual level; first, between people (interpsychological), and then inside the child (intrapsychological)" (Vygotsky, 1978). Just as children learn in this way, so do adults. Collaboration is integral to the process of learning and if we want our teachers to cultivate opportunities for students to collaborate in the classroom, we must provide them with opportunities to develop competencies with and among their colleagues (Eun, 2008).

Teachers play a pivotal role in affecting change and instructional leaders play an important role in building social contexts for adult learning. Examining teacher practice is incredibly important as: "a student assigned to a very good teacher for a single year

may gain up to a full year's worth of additional academic growth compared to a student assigned to a very poor teacher" (Weisberg, Sexton, Mulhern, and Keeling, 2009). More specifically, "a one standard-deviation improvement in teacher effectiveness (going from the average teacher to one at the 84th percentile) would move the average student from the 50th to the 56th percentile in the year with the better teacher" (Hanushek and Rivkin, 2010, p.134). In turning our attention to teachers entering the field as well as in-service teachers with substantial years of experience, we can re-imagine our schools by questioning how we foster and support deeper levels of inquiry for both students and teachers alike. According to Piaget, "cognitive development is a process of adaptation to the environment" (Gredler, 1992, p.18) and, as such, schools need to provide the appropriate contexts, or environments that support learning for all.

Our students demand that we reconsider our behaviors, our attitudes, and our practices. Our students deserve this. According to Jennings and DiPrete (2010), "teacher effects on academic achievement are large relative to the effect sizes of other common dimensions of school quality, such as school resources, instructional interventions, and class size reductions" (p.138). If we are going to improve learning for all, then teachers must be willing to examine their practices as well (Hurd & Lewis, 2005; Toussi & Ghanizadeh, 2012; McLaughlin & Talbert, 2006). It is the role of the instructional leader to facilitate this process.

Vygotsky (1978) attested that "human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (Vygotsky, 1978, p.88). If we expect our children to grow into the intellectual lives of those around them, then surrounding them with teachers who understand the

intellectual development of their students and who are capable of designing instruction in such a way that lends itself to supporting their innate intellectual curiosities can help to support student success.

Alignment Between Professional Development and Teacher Needs. With the vast number of federal, state, and district changes in education reform, such as implementation of the CCSS, and new findings from the learning sciences about how people learn, teachers need differentiated professional development that meets their individual needs (Diaz-Maggioli, 2010) in order to improve their instructional practices and raise their motivation to learn (Toussi & Ghanizadeh, 2012). Reform should lead to changes in instructional practice, however, many schools fall short in meeting these needs, leaving teachers feeling less effective in a high-stakes culture of teaching and learning. According to a report published by the Center for Public Education (2013), some studies show that "teachers may need as many as 50 hours of instruction, practice and coaching before a new teaching strategy is mastered and implemented in class" (p. 14).

In some cases, the goals of professional development may not be aligned with school improvement plans. In addition, state and federal policies under IDEA (2014) mandate that schools provide struggling learners with "evidence-based" practice for instruction. While some teachers receive "on the job training" in content and pedagogy, many do not. Likewise, many teachers report that they have not received training with highly specialized groups of learners (MA TELLS, 2014).

Statement of the Problem and Program Objectives

As teachers develop their knowledge base about new theories of learning and evidence-based practice, new learning paradigms position the classroom as a space where learning is emphasized over teaching, where students take an active role in their learning, where teaching is not done to people, but, rather learning is done by people (Prensky, 2012). Starting with the idea that learners are "active processors of information" (Bruning, Schraw & Norby, 2011) and that "intelligent behavior is based on representations in the mind" or "knowledge structures. . . such as concepts, beliefs, facts, procedures, and models" (Sawyer, 2006), teachers need to understand how to apply theories of learning in the classroom. As Dubinsky, Roehrig, & Varma (2013) point out: "collaborations between neuroscientists and psychologists have produced an expansive literature with myriad interdisciplinary labels" which has led to "a number of educational interventions grounded in psychological principles" (p. 317).

It is the responsibility of the school's instructional leader to ensure that all learning experiences for teachers are embedded within a meaningful context. Principals effect change through their engagement with teachers. In order to improve learning outcomes in the school, principals can support teachers by modeling self-regulated learning through professional development and programmatic support. For the purpose of this study, only teachers' learning experiences will be addressed. This will be accomplished by supporting teachers with their instructional practices through professional development provided in response to their identified needs. While many factors influence the acquisition of skills, this study will focus on exploring the nature of teacher perceptions of self-efficacy, learning, self-regulation of instructional skills, and

professional development in a middle-income northeastern school district among elementary school educators. Essential questions that serve as the foundation for this dissertation are: (1) Which professional development practices support the self-regulated learning of teachers? (2) To what extent does professional learning transfer into adjustments to instructional practice that address learner variability? In addressing these lines of inquiry around instructional practice, learning is situated within the context of teacher development. If we want our students to develop a new cadre of skills, we must begin by developing our teachers.

Chapter Three

Needs Assessment

Context of the Study

Description of the Context. The site of the study (School A) is a public elementary school in the Greater Boston area of Massachusetts that serves over 440 students. It has become a highly desirable school system attracting families from a wide variety of locations. The school has the highest possible accountability rating as a "Level 1" school (Massachusetts Department of Elementary and Secondary Education). Of the 406 students enrolled in 2014, 108 students were classified as "high needs" and 60 students were considered "low income" according to state guidelines.

The data presented in this chapter were obtained during the 2013-2014 and 2014-2015 school years. When needs for the present study were assessed, the primary school teachers served over 400 students in 17 single-age classrooms in Kindergarten through Fourth Grade, 2 multi-age classrooms for students in Grades 1 and 2, and 1 multi-age substantially separate classroom for children with Autism Spectrum Disorder (ASD). The school is accredited by the National Association for the Education of Young Children (NAEYC), is recognized by the International Reading Association, and is an "Apple Distinguished" school. It has a robust team of intervention services including: four Kindergarten Early Intervention Providers (KEIP), two First Grade Early Intervention Providers (FEIP), and a Literacy Specialist who coaches reading tutors and teachers across all five grade levels. There are three special education providers in the Learning Center and the multiage ASD classroom is led by a Board Certified Behavior Analyst (BCBA). During the 2013-2014 school year, there was one certified Principal, two-part time licensed Adjustment Counselors who assist the principal with administrative duties, a .8 School Psychologist, 3 licensed special educators in the "Learning Center," 1 ASD

teacher, 12 paraprofessionals, 2 BCBAs, 1 full-time Speech & Language Pathologist, a full time Library/Media Assistant, a .6 Art Teacher, a .6 Music Teacher, and a full-time Physical Education teacher.

When the first surveys were administered in 2013, approximately 70 students received tier-2 intervention services for literacy, numeracy, speech, behavior, social, or emotional support through related service providers such as KEIP, FEIP, the literacy specialist, and/or school adjustment counselors. All of the school's students receiving Response to Intervention (RTI) services struggled with some aspects of executive functioning, such as cognitive flexibility, self-monitoring, self-regulation, motivation, or goal-oriented behaviors, requiring support beyond that which is offered in the inclusive classroom. Seventeen percent of the schools' students were on IEPs for learning disabilities; the range of support services include: phonology, writing, mathematics, speech/language therapy, occupational therapy, physical therapy, social skills, counseling, and discreet trials. Only four students were on 504 plans.

Supervision of Curriculum, Instruction, and Assessment. The district is also committed to the systematization of collaborative learning structures. Elementary instructional leaders work in conjunction with elementary principals to supervise district grade-level teams which meet monthly. Teachers also meet with their building-based grade-level teams for a minimum of 30 minutes, after-school weekly, and share at least one 40-minute common planning period each week. Curriculum is designed at the district level in professional learning communities and on curriculum writing teams supervised by the Assistant Superintendent. Supervision of instructional practices are handled at the building level through educator evaluations and professional development

is offered during monthly faculty meetings, and curriculum meetings. Each month principals are responsible for organizing a 1-hour faculty meeting and a 1-hour curriculum meeting. Teachers at School A, however, consolidated their meetings to 2-hour curriculum meetings each month. This was determined by the teaching faculty after they determined that they could accomplish more during a 2-hour period. The distinctions between "faculty" and "curriculum" meetings no longer applies to School A since all faculty time is used to advance the professional learning of the faculty and staff. Instead, the principal sends out a weekly newsletter in lieu of faculty meetings. The principal also holds a voluntary Faculty Advisory Council meeting once a month after school; the purpose of this structure is to give the faculty opportunities for feedback on anything from management and operations to curriculum and instruction.

School-wide data teams run three times a year after universal benchmarking periods when all students are screened for intervention in literacy and numeracy. During these meetings instructional leaders such as the principal and literacy specialist meet with grade-level teams of teachers to discuss grade level and classroom trends in achievement data, as well as individual student progress and needs for strategic intervention and progress monitoring. The principal also chairs an Instructional Support Team that meets for 1-hour each week; the team consists of the literacy specialist, school nurse, school psychologist, adjustment counselors, elementary team leader, and assistant director of student services. This team gathers weekly to discuss school-wide improvement, case management, student wellness, and student support services.

Educator Quality. During the 2013-2014 school year, the district was in its first year of full-implementation of the Massachusetts educator evaluation model. As a *Race*

To The Top (RTTT) district, educators had the opportunity to conducted a partial pilot of the model in each of the district's schools during the 2012-2013 school year. RTTT is an initiative designed to improve educator quality, higher standards, and funding to schools. The system shifted to a value-added model by 2016 when "district determined measures" were used to assess educator impacts on student learning. The system requires teachers to develop SMART (Specific and Strategic, Measurable, Action-oriented, Rigorous, Realistic and Results-focused, Timed and Tracked) professional practice and student learning goals as well as conduct ongoing self-assessments. Evaluators provide educators with ratings in four standards (which encompass 33 indicators) based on evidence provided by educators and a combination of unannounced and announced walkthroughs and observations. Professional teachers are on a 2 year cycle, while non-professional teachers have both a formative and summative evaluation annually.

The district has four standards for evaluating teaching and learning: 1) Curriculum, Planning, and Instruction 2) Teaching All Students 3) Family and Community Engagement and 4) Professional Culture. Professional learning and growth is the fourth standard by which educators are assessed and proficient performance under this standard is defined as: "Consistently seeks out and applies, when appropriate, ideas for improving practice from supervisors, colleagues, professional development activities, and other resources to gain expertise and/or assume different instruction and leadership responsibilities" (District Document, 2014). Exemplary performance is defined as: "Consistently seeks out and applies professional development and learning opportunities that improve practice and build expertise of self and other educators in instruction and

leadership. Performance is of such a high level that it could serve as a model for educators" (District Document, 2014).

Target Audience

Given the success of the district's 1:1 technology plan at the secondary level, an elementary technology plan launched in 2014-2015. During that school year, 5 iPads were designated for each classroom, 1 student laptop was assigned and technologies were explored through devices such as Osmo, Chromebooks, and Google Education suites. In order to do this, however, refinements to instructional practice became necessary and an instructional practice survey (IPS) was administered to serve two separate but related functions (a) to examine teacher attitudes, perceptions, knowledge, and experience related to executive functioning and deeper learning for the purpose of informing this dissertation study, and (b) to inform district administrators' understanding of how teacher competencies and levels of comfort with technology might inform professional development needs. Data gathered from the IPS were utilized to inform the district's strategic plan and school improvement plans during the 2014-2015 school year.

School Pilot Studies 2014-2016. It should be noted that data from the needs assessments presented in this chapter were shared with the faculty and staff at School A between 2013-2015. As such, the principal worked with action research teams of teachers in 2013-2014 to examine data and identify pilot studies that could be implemented as future models for learning. These pilots and programmatic changes include: a 30 minute "flexible" learning period each day (implemented 2015), project-based learning through STEAM (implemented 2015), co-teaching in inclusion classrooms (implemented 2015), outdoor learning for 60 minutes per day (implemented 2014), Yoga4Classrooms training

for 40% of the faculty (implemented Spring 2014), and the development of elementary makerspaces to teach "design thinking" (implemented 2015). Data presented in this chapter were analyzed by the school's principal in order to determine teacher needs for professional learning.

District Focus on Deeper Learning. During the 2015-2016 school year, the district's elementary principals began the process of trying to articulate an instructional framework around deeper learning since it requires active cognition and the acquisition of skills that learners can apply to novel contexts (Kivunja, 2015). During the 2015-2016 school year, the district in which this study takes place will devote considerable time to articulating an instructional framework for deeper learning based on the work of Vander Ark and Schneider (2015). Their framework for deeper learning articulates six competencies: (1) master core academic content; (2) think critically and solve complex problems; (3) work collaboratively; (4) communicate effectively; (5) learn how to learn; and (6) develop academic mindsets (Vander Ark and Schneider, 2015). Vander Ark and Schneider (2015) argue that blended and project-based learning are the best methods for implementing these competencies in the classroom. Though they did not conduct professional development in this instructional framework during the school year, it informed some of their feedback to teachers during instructional rounds which take place monthly.

Needs Assessment Research Questions Related to Underlying Causes and Factors Related to the POP

The following research questions are related to underlying causes and factors related to the POP. Data sets that led to the formation of these questions are also provided later in this chapter in order to understand the complexities of this POP (see Table 1).

Table 1. Needs assessment aims and research questions.

Aim 1: To examine teacher perceptions about their level of preparedness in designing instruction within the school's curriculum.	***Research Question 1:*** What are teachers' self-reports of using evidence-based strategies in their current instructional practices?
	Research Question 2: How do teachers' self-efficacy beliefs change after exposure to a professional development sequence?
Aim 2: To determine how current professional development practices do/do not support teachers' instructional practices.	***Research Question 1:*** Does a SMART goal-driven model lead to adjustments in instructional practice?
	Research Question 2: How does lesson study promote self-regulated learning of teachers?

Methods

Participants Including Sample and Participant Selection on the Instructional Practice Survey (IPS).

When initial needs were assessed, an IPS was administered to 140 elementary teachers within the district's five elementary schools via the school principals. Teaching faculty from 5 out of 5 schools responded by mid-June. Sixty-three (45%) of those teachers responded with a range of intra-school participation of 96% to 19%. Although the superintendent and assistant superintendent endorsed the survey, days after the survey was sent to teachers, there was resistance from the Collective Bargaining Unit which demanded 15 minutes of faculty meeting time from principals to

complete the survey due to concerns about use of contract time. Of the 45% of educators who responded, School A had a 96% response rate while other school response rates varied.

IPS Tools and Procedure. The IPS was administered as a census survey intended to gather feedback from everyone within the initial target population of teachers (i.e. all elementary teaching faculty within the elementary schools). It is explanatory in nature and represents an attempt to build an understanding of teacher perceptions across the district. The survey aimed to measure teacher perceptions because research indicates that teacher attitudes and perceptions are positively correlated with student learning outcomes. Also measured by the instrument were perceptions about current levels of preparation to move forward with a new instructional model, as well as perceived levels of competence to meet the needs of "21st century learners" *(see Appendixes A and B).*

The purpose of the needs assessment was to examine perceptions of the role of cognitive engagement and executive function in the district's learning environments. The data (see Tables 2 and 3) were used to inform administrators' understandings of how in-district professional development improves instructional practice, with the goal of designing a professional development delivery mechanism that would increase cognitive engagement and students' executive functioning.

The survey was administered online through Survey Monkey. Participants accessed the survey and consented to taking it through Moodle, the district's digital learning management system. The needs assessment questions were coded, so that they could easily be retrieved from the broader survey responses. Some of the survey data

were used to plan strategically for the next school year while other data points were utilized to understand the problem of practice identified in this study.

Table 2. Instructional Practice Survey (IPS) findings from general questions.

Question	%	*n = 65*
Have been teaching for 10+ years	54%	32
Have been teaching in district for 10+ years	42%	25
Highest level of education (Master's Degree)	81%	48
Number of teachers that go outside of district for professional development needs	92%	55
See the science of how we learn, construct meaning and engage with the world (cognitive engagement) as a top priority in creating 21st century learning environments	44%	26
Number of teachers who "feel prepared, but need a little help" in preparing students to become 21st century learners	56%	33

Table 3. Instructional Practice Survey (IPS) findings from Likert scales.

Question	Strongly Agree (*n*=65)	Agree (*n*=65)	I don't know (*n*=65)	Disagree (*n*=65)	Strongly Disagree (*n*=65)
In my teaching practices, I know how to successfully create: opportunities for children to develop their own goals, work towards meeting them, and adjust when they are not.	15	41	6	0	1
In my teaching practices, I know how to successfully create: opportunities for transfer of knowledge	14	40	4	4	1
In my teaching practices, I know how to successfully create: opportunities for children to be flexible and adapt their thinking.	15	43	1	3	1
In my teaching practices, I know how to successfully integrate: ICT (information, communications, and technology) literacy.	4	20	19	15	5
In my teaching, I know how to successfully	12	46	4	1	0

integrate: metacognitive practices.					
In my teaching practices, I know how to successfully help children to: self regulate.	15	42	3	3	0

Discussion of IPS. After an initial review of the data, a discrepancy between teaching practices and perceptions arose. The vast majority of teachers felt that they knew how to incorporate metacognitive practices into their teaching (*n*=46) while even more felt that they knew how to teach children to self-regulate in the classroom (*n*=57). Forty of the teachers reported that they knew how to teach for transfer. Likewise, most of the respondents reported that they know how to encourage children to adapt and be flexible thinkers (*n=58*) and several (*n*=41) reported that they knew how to create opportunities for children to develop their own goals, work towards meeting them, and adjust them when they are not.

The results of the needs assessment suggested that teachers did not see a problem in their practice when it comes to the explicit teaching of executive functioning (EF) skills which begs the question of how deeply teachers understand EF. As a result of this discrepancy, further investigation and review of data were needed in order to understand teacher perceptions about their instructional practices, and professional development needs. Student learning data were also reviewed in order to measure the alignment between teacher perceptions and student learning outcomes.

Response to Intervention Data. Data from the 2013-2014 Response to Intervention (RtI) Team at School A were collected to determine the number of students

struggling with EF deficits. All students referred to the RtI team struggle with executive function which is inconsistent with what teachers reported in the IPS. Students are referred to the RTI team when they are not making academic progress commensurate with their peers. All students at School A are universally screened three times per year using AIMSweb measures for computation, mathematical concepts and applications, reading comprehension, quantity discrimination, phoneme segmentation, letter sound fluency, letter naming fluency, and nonsense word fluency. The AIMSweb literacy and numeracy measures allow teachers to monitor the progress of their students by comparing their performance against same-age peers within the district. All assessments are locally and nationally norm-referenced. In addition, students' literacy skills are continually assessed through running records, the DRA-2 Reading Assessment, local assessments and end-of-unit assessments. Students are frequently assessed for math instruction using TERC Investigations end-of-unit assessments, as well as district assessments.

RtI Data Tools and Procedure. The following is a breakdown of the RtI data during the 2013-2014 school year. These distinctions for categories were developed using the work of Lynn Meltzer (2007) who defined EF as a term to describe the following behaviors over time (a) goal-setting and planning, (b) organization of behaviors over time, (c) flexibility, (d) attention and working memory systems that guide these processes and (e) self-regulatory processes such as self-monitoring (102). Organization was replaced by motivation, given the age of the students (K-4). Instead, the team used Moran and Gardner's (2007) framework for EF which outlines "hill, skill, and will" to more closely examine motivation (p. 19). The data were reviewed and diagnostic criteria were determined by the RtI Steering Committee and the Executive Functioning Action

Research Team (see Table 4). The Action Research Team consisted of the principal, a certified speech/language pathologist, a certified occupational therapist, a licensed school psychologist, a licensed school adjustment counselor (who also holds an LICSW), a licensed Special Education teacher, a literacy Specialist, and two classroom teachers. This data does not include students receiving tier-2 reading intervention supports through KEIP and FEIP tutors.

Table 4. School A Students in RtI Program (breakdown by function/domain).

Reasons for Referral	**Goal setting and planning** (n = 19)	**Flexibility/ Adaptability in Thinking** (n = 19)	**Self-regulatory processes/ self-monitoring** (n = 19)	**Attention & working memory systems** (n = 19)	**Motivation** (n = 19)
Academic	86%	70%	86%	84%	72%
Social/ Emotional	65%	58%	67%	60%	58%
Behavior	23%	21%	23%	23%	21%

Discussion of RtI Data. The RtI data suggests that a significant number of students at School A struggle with EF, particularly when it comes to goal-setting and teaching children how to self-regulate their cognitive activity, behavior, and emotions. This is inconsistent with what the teachers reported on the IPS. It should also be noted that this data set does not include tier-3 students (on IEPs) at School A. Had the Action

Research Team broken down tier-3 data as well, it is likely that the number of students with significant EF needs would have been higher.

Universal Design for Learning (UDL) Survey Participation. Given the discrepancies found between the IPS and the RtI data, a third assessment was administered to the faculty at School A to drive at a deeper understanding of their knowledge about evidence-based instructional practice. The survey was administered to 22 of the teaching faculty at School A in June 2015.

UDL Survey Procedure and Tools. The UDL survey was designed around the principles of UDL (cast.org). Teachers were asked to rate their feelings of efficacy on a Likert scale from 1-5 with a score of 1 indicating that they "do not know how to do this" and a score of 5 indicating that they "could model this for others." The survey was administered electronically to teachers through a Google application and teachers were given time during a faculty meeting to take the survey. It should also be noted that survey responses were anonymous. Some responses from the survey are listed in Table 5.

Table 5. Universal Design for Learning (UDL) survey.

Competency	**1** **"I do not know how to do this."** (*n*=22)	**2** (*n*=22)	**3** (*n*=22)	**4** (*n*=22)	**5** **"I could model this for others."** (*n*=22)
Providing opportunities for self regulation: developing self-assessment and reflection.	0	3	10	8	1
Providing opportunities for sustaining effort and persistence: heightening salience of goals and objectives.	0	3	9	9	1
Providing opportunities for sustaining effort and persistence: fostering collaboration and community.	0	1	8	10	3
Providing options for comprehension: guiding information processing, visualization, and manipulation.	0	1	10	11	0
Providing options for comprehension: maximizing transfer and generalization.	1	5	10	6	0
Providing options for executive functions: guiding appropriate goal-setting.	0	4	12	5	1
Providing options for executive functions: supporting planning and strategy development.	0	6	9	7	0

Discussion of UDL Data. Data collected from this survey suggested that teachers need more support and development around self-regulated learning. More specifically, teachers indicated that they need more support in planning and strategy development as well as goal-setting with students. This data set led to further questions about teacher development and teachers' feelings of efficacy when it comes to implementing instruction that meets the needs of individual learners.

Massachusetts Teaching, Empowering, Leading, and Learning Survey (TELLS) participation. Until the spring of 2014, the Massachusetts Department of Elementary and Secondary Education (DESE), in conjunction with the Massachusetts Teachers Association (MTA) administered a bi-annual census survey to teachers across the state in order to assess the conditions for teaching and learning in the state's public schools (K-12). In 2014, 330 of 440 teachers in the district participated in the survey which represented a 75% participation rate.

Massachusetts Teaching, Empowering, Leading, and Learning Survey (TELLS) Tools and Procedure. The MA TELLS survey is administered to educators across the Commonwealth. Each respondent is given a unique code so that responses can be recorded. Results, however, are reported anonymously and made public via the MA TELLS website. Though schools are not required to take the survey, some districts attempt to incentivize participation on the survey. The district of the present study did not require educators to take the survey, though some principals provided faculty meeting time for educators to take the survey while others did not. It should be noted that responses to all of the survey questions are also not required. The following survey responses were gathered from the data set in order to assess teachers' self-reports about

their efficacy in meeting the needs of individual learners, their feelings about professional development, and their level of preparation and understanding about recent reforms, such as the Common Core State Standards (see Table 6).

Table 6. Massachusetts TELLS Survey 2014.

Question	Massachusetts Teachers' Responses	District Teachers' Responses
Time devoted to professional development during the contract day.	69% Less than 1 hour *n* = 33,020	68% Less than 1 hour *n* = 286
Involvement in determining the content of in-service professional development programs	65% no role or small role *n* = 35,955	62% no role or small role *n* = 310
Extent to which educators believe that an appropriate amount of time is provided for professional development.	41% strongly disagree/disagree *n* = 31,380	41% strongly disagree/disagree *n* = 323
Extent to which educators believe that professional development is differentiated to meet the needs of individual teachers.	58% strongly disagree/disagree *n* = 35,916	63% strongly disagree/disagree *n* = 303
Extent to which educators believe that follow up is provided from professional development.	49% strongly disagree/disagree *n* = 36,637	32% strongly disagree/disagree *n* = 287
Extent to which educators believe that professional development enhances teachers' ability to implement instructional strategies that meet diverse learning needs.	36% strongly disagree/disagree *n* = 36,201	33% strongly disagree/disagree *n* = 307
Extent to which educators have had 10 clock hours or more of professional development in the Common Core State Standards.	53% No *n* = 30,433	60% No *n* = 268
Extent to which educators believe that the curriculum taught in the school is aligned with the Common Core State Standards.	92% Agree/strongly agree *n* = 34,822	98% Agree/strongly agree *n* = 296

Massachusetts TELLS Discussion. The MA TELLS survey indicated a need for greater teacher involvement in professional learning and development as well as a need for greater emphasis on instructional practice. The data indicates that teachers want professional development focused on instructional practices (or the "how" of teaching) rather than the "what." A significant number of educators indicated that their professional development needs are not being met, as evidenced by their responses to the questions about whether or not professional development is differentiated to meet their specific learning needs. In addition, teachers indicated a need for more professional development that helps them meet the needs of individual learners. Finally, the last two questions in this table show the misalignment between teacher development and recent reform. Although 98% of teachers in the district reported that the curriculum is aligned to the CCSS, 60% report that they have not had 10 or more hours of professional development about them.

Constraints & Implications

The present needs assessment highlights the need for more professional development. Although there was a discrepancy between teachers' self-perceived competencies in delivering instruction that supports the needs of today's learners, perceptions indicate that teachers in the elementary schools may have a high internal locus of control; measuring the alignment between teachers' internal locus of control and instructional practices is an area for further study. Likewise, teachers need to be more deeply engaged in their own learning. Just as teachers within the district reported a desire to have a greater role their professional development, they also believe that their instructional practices directly influence student learning outcomes. Given the role that

creativity and innovation play in classrooms, professional learning communities, and professional development, it is critical that teachers have more opportunities for professional growth. This may be achieved by providing educators with opportunities to innovate in the classroom but it will take strong instructional leadership to make this happen.

Chapter Four

Intervention Literature Review

Overview of the Intervention Related to Underlying Causes or Factors Related to the POP

The intervention was implemented at School A. It was designed to build a community of practice in which teachers could share opportunities to develop a common knowledge base and execute common objectives (Gee, 2008, p. 91). The professional development sequence (see Appendix D) was developed to support the self-regulation of teachers' instructional practices using Pintrich's (2005) model which includes: (a) forethought, planning, and motivation, (b) monitoring, (c) control, and (d) reaction and reflection. The intervention was designed to support teachers in writing focused SMART professional practice goals, to support implementation of Universal Design for Learning (UDL) principles into instruction, to make adjustments to instructional practice based on the needs of individual learners, and to increase their feelings of self-efficacy.

Literature Review

Professional development programs often fall flat, especially when they do not take into account the diverse needs of adult learners. Too often, teachers attend "stand and deliver" professional development that does not take into account their specific learning needs, nor do professional development practices reflect best teaching practices. Diaz-Maggioli (2004) identifies the following as stumbling blocks to real change through professional development: (1) top-down decision making, (2) the idea that teachers need to be 'fixed,' (3) lack of ownership of the professional development process and its results, (4) the technocratic nature of professional development content, (5) universal application of classroom practices regardless of subject, student age, or level of cognitive development, (6) lack of variety in the deliver modes of professional development, (7)

inaccessibility of professional development opportunities, (8) little or no support in transferring professional development ideas to the classroom, (9) standardized approaches to professional development that disregard the varied needs and experiences of teachers, (10) lack of systematic evaluation of professional development, and (11) little or no acknowledgement of the learning characteristics of teachers among professional development planners (p. 2-4). Each of these roadblocks were considerations in developing the intervention.

One of the most crucial roadblocks in supporting teacher development is that of learning transfer (Diaz-Maggioli, 2004). Given what we know about cognitive activity and new learning paradigms, authentic and deep learning is not evident until we see an individual apply their knowledge to a novel context. According to Bransford et al. (2000) "measures of transfer play an important role in assessing the quality of people's learning experiences" (p. 51). As such, there are affective, social-cognitive, and contextual factors that play a critical role in how learners transfer information into new contexts.

Providing teachers with more autonomy over their learning may lead to greater motivation and higher affective states. Motivation to learn something significantly affects transfer of learning and has an impact on the quantity of time that individuals are willing to commit to learning something new (Bransford et al., 2000, p. 60). Learning is also highly contextualized because knowledge is context bound (Bransford et al., 2000). "Learners of all ages are more motivated when they see the usefulness of what they are learning and when they can use that information to do something that has an impact on others – especially their local community" (Bransford et al., 2000, p. 61). If teachers believe that professional development is relevant to their professional contexts, they are

more likely to learn the material, seek out information about the topic at hand, and implement their findings in the classroom.

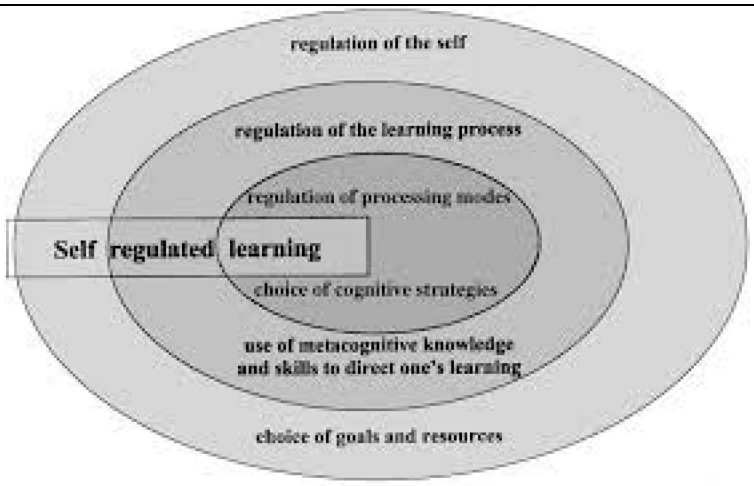
Though there is some deliberation over operationalizing self-regulated learning, it can be defined as the extent to which learners "are participants in their own learning process, that is, how much they consciously set goals; take part in strategic thinking; plan, monitor, and evaluate solutions (metacognition); invest effort to enhance motivation and a sense of self-efficacy; as well as seek help" (Shamir, 2013, p. 98). Just as planning and self-regulation skills directly influence how an individual will learn (Flavell, 1979), these skills have a direct impact on teacher development. Self-regulatory skills have a direct correlation to achievement, social, emotional, and behavioral outcomes for students**.** A teacher's knowledge and guidance in helping children self-regulate will have a direct impact on academic achievement and engagement (Foorman, Schatschneider, Eakin, Fletcher, Motes, & Francis, 2006).

Zimmerman (2005) sees self-regulation as a triadic process in which personal, behavioral and environmental factors play a part. He suggests that SRL assumes a cyclical nature because there are a series of internal feedback loops that remain open. He defines (a) *behavioral self-regulation* as "self-observing and strategically adjusting processes, such as learning," (b) *environmental self-regulation* as "observing and adjusting environmental conditions or outcomes," and (c) *covert self-regulation* as "monitoring and adjusting cognitive and affective states" (Zimmerman, 2005, p.14). Zimmerman also argues that these self-generated thoughts, feelings, and actions are directly connected to the attainment of goals and goal-directed behaviors (2005). The following professional development sequence is structured around these three critical

components of SRL. Participants were asked to engage in behavioral self-regulation by monitoring and adjusting their professional learning in conjunction with making adjustments to instructional practices. While these changes took into account evidence of student learning from formative and summative assessments, participants were given autonomy to develop their knowledge base around specific content standards, practices, and other methods based on their intrinsic motivation for learning. This form of learning should be supported by instructional leaders. Participants, for example, were expected to self-regulate their environment after being exposed to the concept of epigenetics. As such, they engaged in appraisals of the learning environment by observing the learning outcomes and behaviors of their students. Covert self-regulation is more difficult to monitor since many participants lean on their colleagues to reflect on their cognitive and affective states.

Three-Layered Model of Self-Regulated Learning. Boekaerts (1999) developed a three-layered model of self-regulated learning. This model (described in Table 7) posits that learners direct and choose their own cognitive behaviors through the process of metacognition. Boekaerts' model is particularly helpful as it takes into account the integral role that metacognitive processes play in the process of self-regulating one's learning.

Table 7. Boekarts' three-layered model of self-regulated learning.

Boekaerts Three-Layered Model of Self-Regulated Learning


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In 1979, John Flavell noted that "metacognition plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and various types of self-control and self-instruction" (p. 906). Metacognition also plays a role in the areas of social learning theory, cognitive behavior modification, personality development, and education (Flavell, 1979). Learners who utilize metacognitive strategies can retrieve information with higher efficiency and fluidity when they have strategies for thinking and problem solving, demonstrating greater awareness of their strengths and weaknesses, and can better regulate cognitive activity which facilitates the learning process (Pintrich, 2002, p. 222). Building metacognitive capacity relates to all aspects of learning including the development of self-regulation because if one lacks "insight to their own learning abilities, they can hardly be expected to plan or

self-regulate efficiently" (Bransford, Brown, Anderson, Gelman, Glaser, Greenough, and Ladson-Billings, 2000, p. 97).

It is critical to note that self-regulation models underscore the engaged role of individuals in determining their "levels of performance" (Vancover, 2005, p.305). It can be tied to three key aspects of self-regulation: goals, actions, and assessment (Vancover, 2005, p. 306). These three key aspects of self-regulation are crucial components of the intervention, as participants were responsible for self-regulating and self-directing their goals, actions, and self-assessments. The following table (see Table 8) by Pintrich (2005) was developed to identify the phases and areas of self-regulated learning. This table served as a model for structuring learning opportunities for participants of the intervention. Pintrich's (2005) model was utilized to contextualize and assess the efficacy of participants' professional development activities:

Table 8. Phases and areas for self-regulated learning.

TABLE 1 Phases and Areas for Self-Regulated Learning

	Areas for regulation			
Phases	Cognition	Motivation/affect	Behavior	Context
1. Forethought, planning, and activation	Target goal setting	Goal orientation adoption	[Time and effort planning]	[Perceptions of task]
	Prior content knowledge activation	Efficacy judgments	[Planning for self-observations of behavior]	[Perceptions of context]
	Metacognitive knowledge activation	Ease of learning judgements (EOLs); perceptions of task difficulty		
		Task value activation		
		Interest activation		
2. Monitoring	Metacognitive awareness and monitoring of cognition (FOKs, JOLs)	Awareness and monitoring of motivation and affect	Awareness and monitoring of effort, time use, need for help	Monitoring changing task and context conditions
			Self-observation of behavior	
3. Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation of strategies for managing motivation and affect	Increase/decrease effort	Change or renegotiate task
			Persist, give up	Change or leave context
			Help-seeking behavior	
4. Reaction and reflection	Cognitive judgments	Affective reactions	Choice behavior	Evaluation of task
	Attributions	Attributions		Evaluation of context

Until self-regulatory systems are fully developed, children rely on adults to help them regulate their emotions, as well as model how to do this (Lewis, 2015; Aamodt & Wang, 2011). Educating teachers about how they can best facilitate cognitive development is crucial. However, before we can expect teachers to put such SRL opportunities into practice, we must begin by providing them with training to build their knowledge base and promote enduring understanding of brain development. In developing this knowledge base, instructional leaders can draw from a body of research about brain-based learning to educate teachers.

According to Shamir (2013), metacognitive learning has critical implications for teaching and learning because of the shift in responsibility from that of the teacher to that of the learner (Shamir, 2013). Teachers hold the capacity to become chief mediating figures (Shamir, 2013) in the learning process. In schools that support high levels of cognitive engagement, teachers can become metacognitive brokers (Lee & Hung, 2012) and can help students transfer important skills and by mediating student learning experiences across contexts. According to Lee and Hung (2012), teachers can become metacognitive brokers by helping "students adjust, experiment, and transfer learning strategies across formal and informal contexts and to help students develop an 'adaptive-designer' disposition to enhance students' learning in the formal curriculum" (p.464). Likewise, instructional leaders can assist teachers by helping mediate their own learning experiences as well. One of the primary assumptions made about self-regulated learning is that activities can serve as "mediators between personal and contextual characteristics and actual achievement or performance" (Pintrich, 2005, p. 453). When teachers vary their instructional approaches by helping students work in their zone of proximal development (Vygotsky, 1978), they can support students with setting goals, monitoring their progress towards goals, and adjusting their strategies in order to obtain them.

The self-regulated learning of teachers has a direct impact on student learning but more research in this area is needed. Pintrich (2005) argues that cognitive control and regulation includes "the types of cognitive and metacognitive activities that individuals engage in to adapt and change their cognition" (p. 459). As such, teachers may be able to support a student's acquisition of self-regulatory control by self-directing their own learning. Pintrich (2005) defines one's ability to regulate motivation and affect as "goal orientation (purposes for doing task) and self-efficacy (judgments of competence to perform a task), as well as task value beliefs (beliefs about the importance, utility, and relevance of the task), and personal interest in the task (like the content area, domain)" (p. 461). Providing teachers with greater autonomy and opportunities to self-direct their learning may lead to more targeted goal-setting, greater interest in what they are teaching, and raise feelings of self-efficacy.

Learners who have a teacher with a high internal locus of control (LOC) achieve more (Toussi and Ghanizadeh, 2012). Likewise, a teacher's locus of control is associated with motivational factors, including self-efficacy (Toussi and Ghanizadeh, 2012). LOC is also positively correlated with less teacher stress and enhanced motivation (Czubaj, 1996; Toussi and Ghanizadeh, 2012). Teachers with a strong LOC have more positive job outlooks, intrinsic satisfaction, and greater role clarity, as well as more positive perceptions of the school's leadership, organizational structure, and social norms (Toussi and Ghanizadeh, 2012). These points directly relate to a teacher's self-regulatory skills, since a teacher's self-regulation has a direct correlation with her sense of self-efficacy beliefs (Toussi and Ghanizadeh, 2012).

Building teachers feelings of self-efficacy is a crucial step in building capacity. Teachers who believe that they are more capable perform better in the classroom and teachers who believe that their students can succeed, generally have higher student success rates. Zimmerman (2005)

makes two distinctions with regard to self-efficacy; one relates to personal beliefs about having the means to perform effectively and the other refers to outcome expectations, or beliefs about the ultimate ends of performance (p. 17). The proposed intervention wrestles with teachers' personal beliefs about their capacity to meet the diverse needs of learners in their classrooms, as well as their capacity to learn and implement new pedagogical practices. These self-efficacy beliefs are crucial to potential effects of the study as "self-regulatory beliefs causally influence the use of such regulatory processes as academic learning strategies, academic time management, resisting adverse peer pressures, self-monitoring, self-evaluation, and goal-setting" (Zimmerman, 2005, p. 18). How teachers will spend their time, how highly they are motivated, and the efficacy with which they can meet their goals is inextricably linked to these self appraisals.

Teachers who have higher feelings of self-efficacy tend to have higher achieving students. Ross & Bruce (2007) studied the professional development effects on teacher efficacy in a randomized control trial with 106 grade 6 teachers in one district. They found that professional development which explicitly targeted four sources of teacher efficacy from the social-cognitive literature had positive effects. Ross & Bruce (2007) work from a construct of teacher efficacy that includes influencing behavior through: "(a) cognitive processes (especially goal-setting), (b) motivational processes (especially attributions for success and failure), (c) affective processes (especially control of negative feelings) and (d) selection process" (p. 50). Also central to their study was the view that teachers with high-efficacy view failure as an opportunity to persist and see this as an incentive to persevere rather than point to forces that are beyond their control (Ross & Bruce, 2007, p. 51). The researchers provided participants with 1 full day of professional development, as well as three 2-hour after-school follow-up sessions. In providing teachers with professional development, they incorporated mastery experiences,

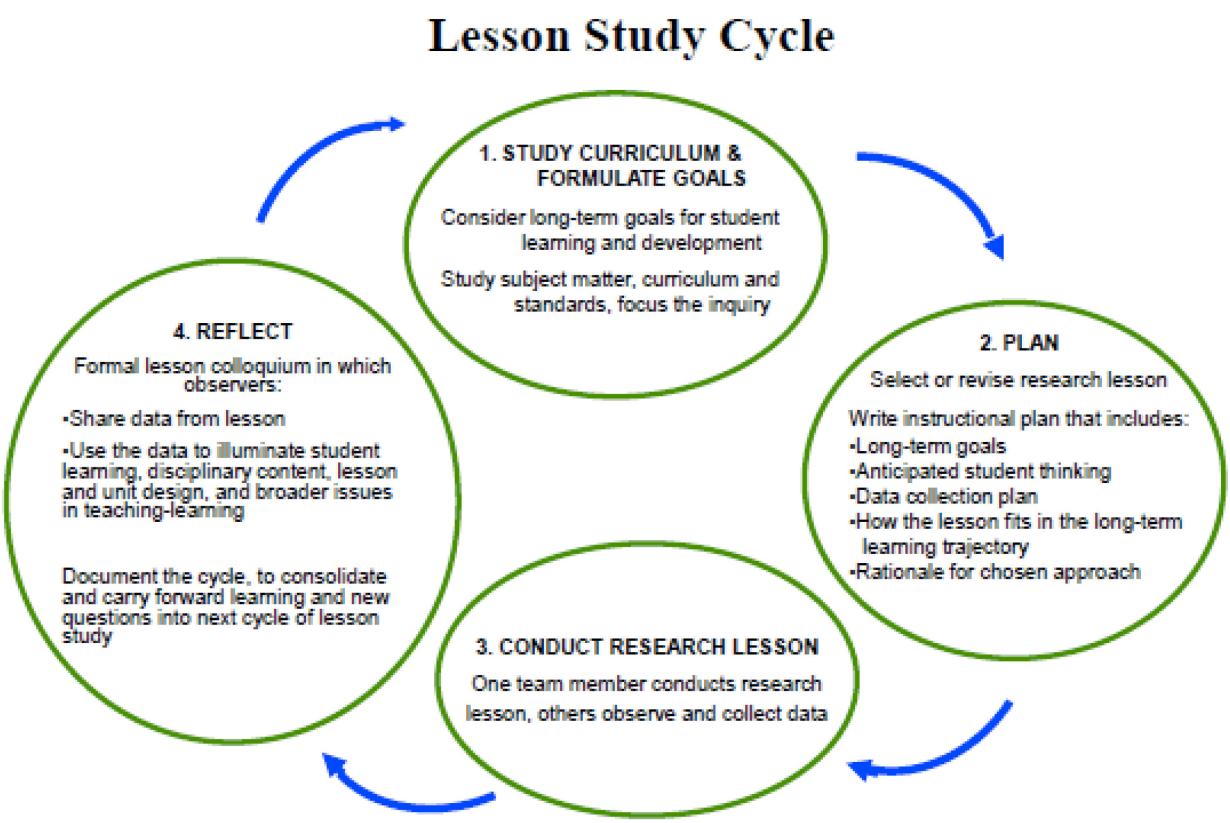
vicarious experiences, social persuasion, and physiological and affective states. Many of the social cognitive strategies employed during the Ross & Bruce (2007) study mirror practices that were implemented in the intervention (see Appendix D).

Over the course of the proposed intervention, teachers had the opportunity to convene in lesson study groups with their colleagues. In establishing a context for learning, participants engaged in the lesson study cycle during the professional development sequence. Teachers who engage in lesson study are required to self-regulate their learning by setting goals, conduct their own research on a topic related to their professional practice, and collaborate with colleagues throughout the lesson study cycle (Hurd and Licciardo-Musso, 2005). They are required to plan, observe, and revise research lessons through the process of collective inquiry (Lewis and Hurd, 2008). During lesson studies, participants at the site of the study sat on grade-level teams of 4-5 teachers who designed, implemented, revised, and researched a lesson connected to the team's SMART goal. Together, they identified a line of inquiry in their professional practice, planned for instruction, taught the research lesson, observed one another, debriefed, revised, and taught it again.

The lesson study cycle is as follows:

Table 9. Hurd's lesson study cycle.

Figure 1



Thus, participants at School A engaged in this process in order to promote their own self-regulated learning, as well as provide opportunities to transfer their knowledge about tiered instructional approaches and evidence-based strategies such as UDL to inform their instructional planning and practice.

Because participants articulated a need to improve their methods in meeting the individual needs of learners, they partook in trainings around the concepts of UDL. To date, there are few instructional frameworks that are steeped in principles of neuroscience and evidence-based. UDL is a framework for designing and implementing instructional practices

that meet the needs of all learners. Informed by findings from the field of neuroscience, it encourages teachers to design instruction that meets the unique needs of learners. Meyer, Rose, & Gordon (2014) use the term "learner variability" as a way to describe the unique needs of each learner, since no two individuals learn in quite the same way. One of the first steps in implementing UDL is acknowledging that cognitive activity is shaped by a number of factors including, but not limited to, anatomy, chemistry, and physiology (Meyer et al., 2014). According to Meyer et al. (2014) there are three primary classes of networks for learning: 1) affective networks that "monitor the internal and external environment to set priorities, to motivate, and to engage learning and behavior, 2) strategic networks which "plan, organize, and initiate purposeful actions in the environment, and 3) recognition networks which "sense and perceive information in the environment and transform it into usable knowledge" (Meyer et al., 2014, p. 54). Educators can activate these networks by providing students with opportunities to learn through multiple means of representation, engagement, action and expression (Meyer et al., 2014, p.54). From this perspective, assessment begins with a discussion of goals, assessment, methods, and materials (Meyer et al., 2014). Teachers then make adjustments to practice by measuring the progress of each individual student.

Although teachers were exposed to the entire framework, they spent the majority of their time working with the study of affective learning through multiple means of engagement (MME). By providing options for recruiting interest, providing options for sustaining effort and persistence, and providing options for self-regulation, participants were expected to gain exposure to the entire MME framework between November 2015 and March 2016 (Meyer et al., 2014). Affective learning spans across academic domains as well as social, emotional, and behavioral aspects of a child's growth. Participants were exposed to concepts about the bi-

directionality of the nervous system and how cognitive activity and emotional processing are so entangled that they cannot be separated from one another (Meyer et al., 2014, p. 60). Such a perspective on learning challenges traditional views in which thinking, social, emotional, and behavioral skills were dichotomized as "cognitive" and "non-cognitive" activities.

Providing students with learning opportunities through MME means that students have more "voice and choice," that students develop the "internal standards" and motivation to learn as individuals vary in their levels of comfort with risk-taking, social dynamics, attention, and spontaneity (Rose, Harbour, Johnston, Daley, & Abarbanell, 2006). Likewise, the affective networks in the brain tell us whether "patterns we perceive matter to us and whether they are important, and then they help us decide which actions and strategies to pursue" (Rose et al., 2006, p. 138).

Rose et al. (2006) provide an overview of Universal Design for Learning and discuss the application of the framework's principles in designing a post-secondary course called T-560: Meeting the Challenge of Individual Differences taught by a team of faculty at Harvard Graduate School of Education. The course was designed to address recognition networks, strategic networks, and affective networks of the brain through multiple means of expression, multiple means of representation, and multiple means of engagement (Rose et al., 2006). The researchers did this by providing students with multiple means of representation through the use of recorded lectures, student notes posted on the class site, and class presentations that incorporated little text, more graphic representations, video, autonomy in scaffolded discussion groups and course readings, as well as multimedia (Rose et al., 2006). The faculty also provided students with multiple means of expression by providing them with a variety of assessment methods that went beyond traditional quizzes, tests, and papers (Rose et al., 2006). Faculty who teach the course

provided students with MME by providing them with a variety of options; students chose from websites, research papers, presentations, and lessons to demonstrate their application of course material (Rose et al., 2006).

In a different study by Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder (2007), researchers studied the impact of a one hour Universal Design for Learning training session on teacher lesson plans in an education course at a southeastern university. Spooner et al. (2007) defined MME as providing students with "flexible alternatives." Their randomized control study contained a three-factor analysis of variance with repeated measures to assess the lesson plans, pretest, and posttest scores in treatment and control groups comprised of 72 general education and special education teachers. The experimental group demonstrated considerable growth (M = 0.98 pretest; M = 3.34 posttest) over the control (M = 0.77 pretest; M = .077 posttest). The researchers found a positive correlation between the 1-hour UDL lecture and the teachers' ability to write lesson plans that incorporate multiple means of engagement, representation, and expression (Spooner et al., 2007). Spooner et al. (2007) developed rubrics and protocols for assessing lesson efficacy and content validity was measured by an "expert panel" of professors from the university. The study is especially promising, considering that their study addressed previous concerns raised over lack of training, time constraints, student performance levels, or classroom management (p. 114).

In order to influence the children, however, we must begin by training teachers. Teachers who know how to regulate their own emotions are more effective classroom managers, less prone to burnout, promote greater social engagement among peers, and may have a greater impact on student learning outcomes (Jennings & Greenberg, 2009). At present, there are a number of studies designed to evaluate the effects of the UDL framework. These studies,

however, focus on treatment effects on students, rather than its influence on teacher development.

Statement of the Proposed Solution

Teachers participating in the intervention attended a professional development sequence designed by the school's principal. The sequence reflected an alignment between the school's improvement plan, district improvement goals, as well as teacher learning needs which were reflected in their SMART professional practice and student learning goals. Teachers participating in the study designed professional practice goals that related to some aspect of their instructional practice they wanted to investigate, refine, and improve. Such a model supports a "pedagogy of investigation" (Klein & Riordan, 2009) through a "community of practice" (p. 63).

Professional development was provided to teachers through faculty, curriculum, and data meetings. The content chosen for these meetings was driven by UDL principles and tiered instructional approaches that help participants meet the variable needs of learners. During these meeting times, participants also had time to work on making adjustments to their instructional practice by collaborating with colleagues on their lesson studies and by participating in activities, designed to help them become more adept at meeting individual student learning needs.

During the intervention, participants received targeted feedback on their progress from colleagues and from their evaluator. Those who implemented the intervention with fidelity incorporated UDL principles into daily instruction. In addition, they applied self-regulated learning strategies, such as persistence and targeted goal setting through the lesson study cycle. Successful participation in the evaluation of the intervention required that teachers attend all trainings, completed all assessments associated with the training, participated in focus groups, and provided the student investigator with feedback about how it went.

Research Questions for Proposed Solution

This study was designed to measure the relationships between professional development, teachers' self-regulated learning, and teachers' feelings of self-efficacy in meeting the needs of individual learners. Questions guiding the study are as follows: (a) what are teachers' self-reports using self-regulation strategies in their instructional practice? (b) how might teachers' self-efficacy beliefs change over the course of a professional development sequence designed to foster an understanding and implementation of the principles of Universal Design for Learning and lesson study? (c) which professional development practices improve the self-regulation of teachers? and (d) how does lesson study promote the self-regulation of teachers?

Chapter Five

Intervention Procedure & Program Evaluation

Methods

The intervention designed to address the Problem of Practice was implemented during a professional development sequence at School A. Since a single outcome measure is not always adequate in assessing outcomes (Rossi et al., 2004), multiple measures were utilized to assess program outcomes. Mixed methods used to study the proposed intervention were designed around the principles of program evaluation monitoring because it is a "technique for generating feedback to help program managers better administer and improve their programs" (Rossi et al., 2004, p. 225). Given time constraints, and the investigator's relationship to the participants in the study as designer, implementer, and evaluator, this was the most effective plan for evaluating the intervention.

Sample, Participant Selection, and Site Identification. The intervention was provided to 24 members of the teaching faculty at School A. The following represents a breakdown of teaching roles and responsibilities within the target population: 4 kindergarten teachers, 3 first grade teachers, 3 second grade teachers, 3 third grade teachers, 3 fourth grade teachers, 4 multi-age teachers (2 of whom teach a combined age classroom for 6 and 7 year olds and 2 of whom teach a combined age classroom for 8 and 9 year olds), 3 special educators who teach in inclusion classrooms, and 1 substantially separate special educator who ran a program for students with ASD. Participants were chosen using a convenience sampling method. It should be noted that this sample represents 100% of the teaching faculty at School A. The decision to include 100% of the faculty was largely driven by the need to include all of the teaching staff, as it would not be ethical for the student investigator, who was also the school's principal, to exclude staff from professional development. Participants provided oral consent to participate in this study (see Appendix E).

Procedure. The intervention followed the principles of an interrupted time series design with quantitative assessments conducted prior to the intervention and after, observations collected during the intervention period, and focus groups conducted after implementation. Program outcomes will be assessed according to four indicators: (1) goal-setting; (2) instructional planning and practice guided by UDL; (3) educator reflections; and (4) teacher feelings of self-efficacy.

Table 10. Data collection matrix.

Indicator	Role of Indicator	Data Source(s)	Frequency	Responsibility
Goal setting	Outcome	Teacher SMART goals	Once in Fall (by October 15, 2015	Principal (Evaluator)
Instructional Planning	Outcome	Lesson Study Plans	2 Plans written between December 2015-March 2016	Principal (Evaluator)
Observed Instructional Practices	Outcome	Teacher observations	1 observation conducted between December 2015-March 2016	Principal (Evaluator)
Educator reflection	Outcome	Focus Groups	March 2016	Principal (Evaluator)
Self-Efficacy	Outcome	Teacher Survey	Pretest administered in December 2015; Posttest administered in March 2016	Principal (Evaluator)

The logic model (see Appendix D) takes into account theories of treatment presented by researchers in other educational settings (Kang, Cha, & Ha, 2013). Its purpose is to clearly identify intervention inputs to establish fidelity of implementation, as well as clear mediators and outcomes to determine fidelity of intervention.

Goal Setting. Developing SMART (Specific, Measurable, Achievable, Results-focused, and Timebound) goals with the aim of improving professional practice was one of the intended treatment outcomes of the intervention. At the time when the intervention was delivered, all teachers in the district were required to write two annual SMART goals; one was a "professional practice" goal and the other was a "student learning" goal. In past years, there was a high level of variability in the quality of these SMART goals. While some educators wrote goals that were not achievable in past years, others wrote goals that have little connection to their professional practice, and some wrote goals as a means of completing a "compliance" task. All SMART goals must be completed by October 15th, in order to comply with collective bargaining agreements. SMART goals were reviewed using a protocol designed to measure the presence of alignment between the participants' lesson studies and their professional practice goals (see Appendix F).

Instructional Planning. Participants engaged in a formal lesson study during the intervention. As such, they were asked to capture their research questions and lesson study goals into the design of their lessons. Participants created lesson plans that incorporated the principles of UDL, as well as other topics that came up throughout the course of their research through this cycle of inquiry. Lesson plans were assessed using a protocol to determine the presence of concepts learned during the professional development sequence, the number of resources they included in designing their lessons, and the degree to which they made adjustments to practice

after teaching the lesson for the first time (see Appendix G). Participants used the lesson study planning form to plan for instruction (see Appendix G). These forms were adapted from Hurd & Lewis (2005).

Observed Instructional Practices. During the period in which the intervention was delivered to participants, the student investigator documented one observation in each classroom using a protocol for observing and analyzing principles of UDL in direct instruction (see Appendix H). These walkthrough observations lasted between 45-60 minutes. The protocol was used to assess various components of UDL such as providing options for self-regulation, providing options for sustaining effort and persistence, and providing options for recruiting interest (www.CAST.org). Although close attention was paid to observing the UDL checkpoints associated with MME, all UDL checkpoints were on the observation checklist in order to establish the presence of UDL features in instructional practice. Field notes were gathered in order to note the presence the participants' learning transfer from professional development as well as further insights that may have indicated something about their instructional practices. Written reflections are optional in this school, due to collective bargaining agreements. Forty percent of participants completed written reflections after these observations. In some cases, these written reflections provided further insight into participants' instructional planning or feelings of self-efficacy. However, because participant completion was highly variable, therefore, these are not included in the present study. It should be noted that the student investigator has considerable training in how to analyze teaching and learning through observation including eleven years of experience as an education practitioner, six years of job experience as an evaluator, a graduate degree in education leadership, and several hours of

district-level trainings. Five months prior to starting the intervention, the student investigator also took a graduate course with CAST in how to implement UDL in the classroom.

Educator Reflections Through Focus Groups. In order to get feedback from teachers about whether or not teachers believe that the intervention was helpful to them in designing instruction that meet the individual needs of learners, teachers provided their feedback about the intervention during small focus groups of 4-5 teachers (see Appendix J). Because of the student investigator's relationship to participants as a supervisor, five separate focus groups were facilitated by an LICSW not associated with the study and participants responses were recorded on a digital voice recorder and sent to a transcription service in order to obtain an exact transcript of participants responses. Though participants were grouped by grade level team, they were not identified in the transcripts by name so that they could provide honest responses. In order to eliminate potential bias, transcripts were coded using NVivo software which identified key words and phrases. This allowed the student investigator to extrapolate themes among participants responses. In addition, the facilitator scored participants responses using a 5-point scale which rated participants' answers from "very helpful to planning" to "not at all helpful." The facilitator's ratings on this scale were measured against the student investigator's ratings as another precautionary measure to eliminate potential bias. No follow up questions were asked in order to compare participants' responses. Responses were used in order to develop a deeper understanding of how participants responded to the intervention and to make adjustments to practice for professional development.

Pre and Post Assessments to Assess Teacher Efficacy. Pre and post assessments were administered to participants to measure the efficacy of the intervention. The pre-assessment was administered to teachers during a faculty meeting in the fall of 2015 (see Appendix K). The

assessment contained a series of questions related to their feelings of self-efficacy, confidence in their knowledge base about utilizing principles of UDL in their instructional practice, and their confidence in implementing math practices (see Appendix K). Participants rated their perceptions using a Likert Scale (1-5) before and after the intervention. Participants took a post-assessment in March 2016 after exposure to the intervention. The post-assessment contained optional open text fields for participants to indicate which UDL checkpoints they learned the most about, whether or not the intervention had an impact on their instructional practice, and whether or not the intervention met their expectations. Both the pre and post assessment measures took participants approximately 15 minutes to complete. In order to avoid "corruptibility of indicators" (Rossi et al., 2004), surveys were anonymous so that participants did not feel as though they need to inflate their scores in order to receive a better performance evaluation from the student investigator.

High levels of efficacy with regard to fidelity of implementation were anticipated because the crucial inputs of the intervention were embedded into the daily practices of educators in the student investigator's school. The student investigator is responsible for supervising and evaluating educator goals, self-assessments, and practices in teaching and learning. By developing a coherent plan for professional development that supports the work of teachers through the intervention, it was anticipated that all participants would adhere to implementation and would be exposed to the treatment for the same duration of time. Given that all subjects were be exposed to the treatment, there were no counterfactual conditions to compare the treatment group against. Hence, ensuring that a service utilization plan and program organizational plan are clear was necessary.

Fidelity of process was more difficult to measure due to a variety of issues. In order to achieve high quality of delivery, consideration was given to providing teachers with rubrics that explain what high fidelity of implementation in instructional planning looked like. However, due to time constraints and the myriad responsibilities of participants outside of the study, this was not provided. It is also important to note that the extent to which participants engaged in the treatment varied from participant to participant due to perceived needs for the intervention, previous exposure to UDL, or personal issues that impact the amount of time they can devote to instructional planning outside of the contractual school day. With regard to attrition, one participant did not join the focus groups or complete the post-assessment due to family leave.

All professional development, support, and materials were delivered with high fidelity of implementation between the fall of 2015 and spring of 2016. This means that there was a strong content focus, opportunities for active learning, coherence between goals, and collective participation. Participants had the chance to engage in active learning by applying their knowledge of MME during peer observations and lesson study.

Strengths and Limitations of the Design. The design is constrained by several factors that have to do with the student investigator's relationship to the participants in this study. First, the intervention must be provided to the entire teaching faculty because the student investigator is also the school's instructional leader. The intervention can not be provided in another setting due to the professional obligations of the student investigator. Thus, there is only one treatment group with no control group. This is largely due to the ethical issues; as a principal, the student investigator can not offer the treatment to some and not others. The size and attrition of the sample group posed some threats to validity given that one of the participants left in March for a maternity leave.

One of the most substantial limitations posed by this study has to do with the amount of time to intervene with participants. An impact study is not possible due to the 4-month window of time; this limits the participants' exposure to the intervention. If such time constraints were not an issue, it would be desirable to identify findings from process evaluation plan to design a longitudinal impact study, through a randomized control trial, to study the causal relationships between the professional learning of participants, their instructional instructional methods, and student learning outcomes over multiple years. In order to accomplish this, treatment and intervention groups would be matched by examining the participants' socio-economic status, race, and ethnicity in Level 1 schools in the state of Massachusetts during the first phase. Participants might also be matched by identifying their levels of preparation, as well as performance ratings according the Massachusetts Model Educator Evaluation system.

Anticipating valid outcome change and isolating program effects was also a challenge because participants engaged in other district-level professional development during the 2015-2016 school year over which the student investigator had limited control or and little involvement in designing. Also, factors that influence change, such as professional development that teachers will engage in outside of school or unanticipated mandates from the Department of Elementary and Secondary Education were variable and based on a teacher's professional interests. The entire teaching faculty engaged in some type of professional development outside of their work day; topics ranged from instructional workshops in pedagogy and teaching methods, content-based learning, and graduate coursework associated with professional advancement.

One of the limitations of this study was also a tremendous strength: that of the student investigator's relationship to the participants. The study afforded the student investigator with

the opportunity to better understand the impact of professional development on teacher learning and professional practice, as well as make adjustments to professional development practices based on the participants' articulated needs. The study also gave the student investigator the opportunity to determine the frequency with which participants were able to transfer (or not) their professional learning into observed instructional practice.

Chapter Six

Findings

Results of the Analyses Organized by Study Question

The findings from this study indicated that the intervention did have an impact on participants' instructional practices. The degree to which the intervention had an impact, however, varied among participants. The intervention accomplished both aims of the study: 1) to examine teacher perceptions about their level of preparedness in designing instruction within the school's curriculum and 2) to determine how current professional development practices do/do not support teachers' instructional practices. Quantitative and qualitative data collected throughout the intervention is presented in this chapter and organized around the research questions.

Two research questions guided the first aim of this study: 1) what are teachers' self-reports of using evidence-based strategies in their current instructional practices? and 2) how do teachers' self-efficacy beliefs change after exposure to a professional development sequence? Both the quantitative and qualitative data sets were used to determine the participants' responses to these questions. Participants' responses on the pre and post assessment surveys were utilized as well as participants' reactions during focus groups. Because the research questions frame the nature of the study before and after the intervention, findings are presented together below.

After exposure to the professional development sequence, participants reported higher levels of self-efficacy with regard to designing instruction through multiple means of engagement. The table below (see Table 11) reflects participants self-reports on pre and post assessments. Between the pre and post assessments (see Appendix K), teachers self-efficacy beliefs increased after exposure to the professional development sequence. Participants reported higher levels of efficacy in implementing UDL instruction that targeted multiple means of

engagement (MME). This was an expected finding since UDL training for teachers targeted MME. This was observed in the pre and post assessments, focus groups, and observations.

Table 11. Participants self-reports of using evidence-based strategies in instructional practice that provides students with opportunities for multiple means of engagement *(note: the table includes participants who rated themselves as a 4 or 5 on the assessment; participants who rated themselves as a 3 or lower are not included here).*

UDL Checkpoint	Number of participants reporting self-efficacy on pre-assessment (*n* = 24)	Number of participants reporting self-efficacy on post-assessment (*n* = 24)
7.1 Provide options for recruiting interest: optimize individual choice and autonomy	14	16
7.2 Provide options for recruiting interest: optimize relevance, value, and authenticity	10	15
7.3 Provide options for recruiting interest: minimize threats and distractions	13	17
8.1 Provide options for sustaining effort and persistence: heighten salience of goals and objectives	14	15
8.2 Provide options for sustaining effort and persistence: vary demands and resources to optimize challenge	13	20
8.3 Provide options for sustaining effort and persistence: foster collaboration and community	14	22
8.4 Provide options for sustaining effort and persistence: increase mastery oriented feedback	10	11
9.1 Provide options for self-regulation: promote expectations and beliefs that optimize motivation	19	21
9.2 Provide options for self-regulation: facilitate personal coping skills and strategies	17	21
9.3 Provide options for self regulation: develop self-assessment and reflection	15	21

Self-reporting higher levels of efficacy with regard to designing instruction that provides multiple means of engagement was an expected outcome of the intervention for two reasons: 1) the professional development was designed around principles of engagement and 2) participants partook in activities designed to develop their knowledge base around MME principles. Participants also reported high levels of confidence designing instruction around MME.

The greatest area of self-reported growth within the MME framework was related to fostering collaboration and community. While causal factors related to this self-report are not easy to identify, this may be directly related to the school's professional culture. During each of the focus groups, the word "collaborative" was used by every team of participants to describe the school's culture. Participants also reported higher levels of efficacy providing instruction that optimizes relevance, value, and authenticity. This may be a function of using a model for project-based learning in planning for instruction. During focus groups, several participants reported that they are planning project-based instruction; one of the team's reported that they wanted more time for project-based instruction. Finally, providing options for self-regulation by developing self-assessments and reflection was another area where participants reported higher levels of self-efficacy. This may be related to the participants' lesson study which required them to collaborate with colleagues and reflect.

In many cases, exposure to the UDL framework led participants to identify UDL practices in their instruction. Although participants self-reported lower levels of implementation of instructional practice that targeted multiple means of action and expression (MMAE) as well as multiple means of representation (MMR) on the pre-assessment, they self-reported higher levels of implementation on the post-assessment, despite their lack of exposure to training on these dimensions of the framework. This was not an expected outcome.

Table 12. Participants self-reports of using evidence-based strategies in instructional practice that provides students with opportunities for multiple means of action and expression as well as multiple means of representation *(note: the table includes participants who rated themselves as a 4 or 5 on the assessment).*

UDL Checkpoint	Number of participants reporting self-efficacy on pre-assessment (*n* = 24)	Number of participants reporting self-efficacy on post-assessment (*n* = 24)
1.1 Provide options for perception: offer ways of customizing the display of information	7	12
2.3 Provide options for language, mathematical expressions, and symbols: support decoding of text, mathematical notation, and symbols	5	12
2.5 Provide options for language, mathematical expressions, and symbols: illustrate through multiple media	4	15
3.3 Provide opportunities for comprehension: guiding information processing, visualization, and manipulation	11	23
3.4 Provide options for comprehension: maximize transfer and generalization	3	17
5.2 Provide options for expression and communication: use multiple tools for construction and composition	6	13
6.1 Provide options for executive functions: guide appropriate goal-setting	13	17
6.2 Provide options for executive functions: support planning and strategy development	9	16
6.4 Provide options for executive functions: enhance capacity for monitoring progress	9	14

One possible explanation for the discrepancy between participants' self-reports of MMR likely has to do with the focus on the development of SMART goals. Four of the five teams focused their instruction on mathematics content. In designing and implementing math instruction, participants identified alternative ways to "represent" concepts of numeracy in order to differentiate instruction and make it highly engaging for students. Another area where participants reported higher levels of self-efficacy on the post-assessment was in providing options for language, mathematical expressions and symbols by illustrating through multiple media. Although this checkpoint belongs to the MMAE aspect of the framework, professional

development was delivered through a blended format where participants accessed content through videos, Google software, face-to-face time, and software offered by the district. Integration of the TenMarks program for numeracy instruction in Grades 1-4 (designed by Amazon) was mandated by the district in the middle of the intervention. All of the participants complied with this mandate. This might have had an influence on how participants self-reported their level of engagement with technology. Finally, one of the most significant findings was how teachers self-reported their efficacy in providing options for comprehension by maximizing transfer and generalization. This was an expected outcome; however, the findings were more significant than anticipated. One possibility for this may be related to the amount of time and support participants were given to write curriculum to support project-based learning. All teams were provided with time to plan PBL instruction during faculty and curriculum meetings and two of the five teams articulated a desire to spend time outside of their contract hours to plan for PBL. Six of the participants were recognized for their leadership in this area. All six took on school leadership roles while four of them presented at a statewide conference for elementary school principals. Participants also demonstrated enthusiasm for project-based learning during focus groups. One other possibility for this outcome may have to do with the professional development methods of delivery used. The lesson study was designed to provide participants with opportunities for learning transfer. To what extent this impacted the teachers' self-reports, however, is not clear. This could be an area for future study.

Two research questions guided the second aim of this study: 1) does a SMART goal-driven model lead to adjustments in instructional practice? and 2) how does lesson study promote the self-regulated learning of teachers? Protocols to review the participants' lesson plans and SMART goals were used in order to answer these questions, as well as protocols for observed

instructional practice. Participants' focus group responses were also helpful in identifying which professional development and other factors led to adjustments to practice and the self-regulation of instructional skills.

Findings show that a SMART goal-driven model leads to adjustments in instructional practice. Participants' SMART goals were reviewed using a protocol (see Appendix F) designed to measure the alignment between teacher's professional practice goals and the lesson study. In reviewing their goals, all of the participants' SMART goals (n = 24) related to the school's improvement plan goals and 100% of the goals incorporated the targeted research question for their lesson studies. While the content focus of the participants' SMART goals varied by grade level team, they identified important aspects of their instructional practice in articulating their goals. The participants' SMART goals are listed below (see Table 13). One hundred percent of participants at School A articulated that they are on track to meet their goals by the end of the school year on the post-assessment and during focus groups.

Table 13. Participants' professional practice SMART goals.

Grade Level	SMART Goal
Team A	Teachers will implement the Social Thinking curriculum as a tier 1 intervention for all students and from there, identify 3-6 Tier-2 students who are not making steady progress relative to their peers in either social, emotional or academic areas. Tier-2 students will move up at least one indicator on the "Flexible Thinker" rubric with fading adult support by June 2016.
Team B	In conjunction with Lesson Study for the 2015-2016 school year, the Grade 1 teachers will identify engaging teaching practices around exposure to the concept of place value currently used in our classrooms. We will improve and incorporate new ideas and methods into our teaching of place value with first graders through peer coaching and observations. Students will show increased understanding of place value concepts as measured by the relevant questions on the [school department's] math benchmark assessments and additional teacher created assessments and observations.
Team C	By May 2016, the second grade team will have used multimodal approaches to teach, apply, and practice addition and subtraction math facts within 20, which could be applied to single- and multi-step problem solving with increased fluency and more efficient numerical reasoning.
Team D	(1) By the end of the school year, all third grade students will master multiplication facts up to 10, as evidenced by scoring a 16/20 or above on {the school department's] end-of-year fact assessment. (2) By the end of the school year, students will demonstrate mastery in highlighting patterns, critical features, big ideas, and relationships in math computation units after exposure to differentiated learning experiences as measured by formative and summative assessments.
Team E	By the end of the implementation of Investigation's Grade 4 Unit 6: Fraction Cards and Decimal Squares, 85% of students will increase their performance on a task that assesses their ability to order fractions with unlike denominators on a number line with landmark numbers of 0, 1/2, 1, and 2 by at least 20% (one point).

Given the findings that 100% of the participants were on track to meet their professional practice goals at the time when data was collected, it appears that a SMART goal-driven professional development model can lead to adjustments in instructional practice provided that teachers

review their goals often. Developing SMART goals was not a new practice for the participants. However, returning to their goals at virtually all faculty, curriculum, and data meeting times was new. The lesson study provided not only the vehicle by which they could implement professional learning but also an accountability measure. While teams varied in how they executed the implementation of their goals, all of the participants made strategic attempts to adjust their instructional strategies by collaborating with their colleagues and assessed their efficacy by measuring student learning through assessments such as local benchmark assessments, and one formative measure designed by the participants (in the case of Team A). All of the participants' SMART goals related to the team's research questions for lesson study.

All of the participants (n = 24) articulated that they would meet their instructional practice goal during focus groups. However, one team (TEAM A) had to amend their goal at the mid-year point in order to meet it. This team changed their goal to an implementation goal (see Table 13), as they decided to pilot a new curriculum around Michelle Garcia Winner's Social Thinking curriculum which focuses on building student capacity for self-regulation, because once they developed a deeper understanding of the curriculum, they felt that their original goal was not realistic. Amending the goal represents their ability to reflect on their practice, work towards a goal, and adjust strategies as needed.

Evidence of UDL planning was present in all of the teachers' lesson studies (n = 24). However, the degree to which teachers demonstrated their knowledge of UDL design principles was variable. Some teams made explicit and strategic connections to the UDL checkpoints while other teams used language that alluded to checkpoints within the UDL framework. Below is an example of one of the team's lessons (see Table 14).

Table 14. Sample lesson study plan.

1. **Title of the lesson:** They're Related and You Know It, Part 1

2. **Research theme (Long-term Goals), Broad Subject Matter Goals, Lesson Goals, Standards, and Objectives:**

   Research Theme: Addition and Subtraction Reciprocity

   Broad Subject Matter Goals: We want students to understand that different operations are related (reciprocal) and that they can use the opposite operation to solve computational problems. We hope that by building their understanding of the relationship between operations, students will be able to solve facts more efficiently and apply these skills to more challenging problems.

   Lesson Goals: Students will use multiple media to comprehend and apply the reciprocal relationship between addition and subtraction.

   Standards:
   CCSS.Math.Practice.MP1: Make sense of problems and persevere in solving them.
   CCSS.Math.Practice.MP2: Reason abstractly and quantitatively.
   CCSS.Math.Practice.MP7: Look for and make use of structure.
   CCSS.Math.Practice.MP8: Look for and express regularity in repeated reasoning.
   CCSS.Math.Content.3.OA.D.9: Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.

   Objectives:
   I can identify reciprocal relationships between addition and subtraction.
   I can create addition and subtraction fact families with three related numbers.

3. Lesson Rationale: Why we chose to focus on this topic and goals. For example, what is difficulty about learning/teaching this topic? What do we notice about students currently as learners? Why we designed the lesson as shown below.

Students are missing the conceptual understanding behind reciprocal operations and fact families. They do not use addition to understand or solve subtraction and vice versa. We are working to use multiple media to support students' comprehension of the reciprocal relationship between subtraction and addition.

4. Data collection points during the lesson observation.

Our team will collect data on: applied understanding of reciprocal relationships and fact families as evidenced by the exit ticket, small group teacher observation and note-taking, as well as reviewing work completed in pairs/individually in centers. Our ultimate objective is that the data collected during mid- and end-of-year assessments will show improvement (specifically, 85% proficiency across the grade).

5. Connection to Universal Design for Learning Principles:

How will you address affective brain networks? The affective brain networks largely deal with the 'why' of learning; we strive to provide an engaging learning opportunity for students. Our initial goals

are that students have some level of choice, are challenged, and are interested in the work.

Choice: One of the centers students will be visiting will allow them to choose the media that helps them practice their facts in the best way. We believe that providing this choice will help them to internalize the facts.

Challenge: Students were selected for their groups based on base-line assessment data; challenges are designed specifically to meet their needs in a small-group setting.

Interest: Facts are not, in-and-of themselves, particularly interesting. Multiple modes of representation and expression (technology, games, and traditional triangle cards) will increase students' interest.

- Lesson Framework:
  - 15 minute mini lesson
    - Establish norms (and consequences)
    - Establish Learning Target, How you know you are on track
    - Explain Centers
  - 3 Centers that 3 Groups work through (Groups are based on beginning of year facts assessments)
    - Reflex/Ipods/Fact Triangles
    - Game - represent reciprocal relationships between
      - Fact Family game: dominos on one side, fact-family dice (dodecahedron) -- Link to Template
      - algebra extension
    - Work with Teacher
  - Instructional Groups will be 15 minutes long and will be differentiated according to need
    - Lowest: Review Game, Relationship between fact families
    - Middle Group: Around the World with addition and subtraction
    - Highest Group: What does the = sign mean?
  - Exit Ticket - Which was most helpful for you and why? - Create the fact family that matches these numbers: 3, 4, 7. Extension- replace a number with an 'x' in your representations.

What is the teacher doing?	What are the students doing?

Mini-lesson & establish norms/expectations (10-15 minutes)
• Establish norms (and consequences)
  ○ Mystery Engaged Learner
• Establish Learning Target, How you know you are on track
  ○ Learning Target: identify and apply fact family relationships
  ○ On-Track: use addition facts to help you solve subtraction facts
• Explain Centers
Centers: (45 minutes total)
• 15 minutes per center
  ○ Game - represent reciprocal relationships between
	Mini-lesson & establish norms/expectations (10-15 minutes)
	• Listening with rapt attention and serious devotion to their learning.
	
	Centers: (45 minutes total)
	• Roll and Write Game (15 minutes): Students

▪ Fact Family game: fact-family dice (dodecahedron) -- Link to Template ▪ algebra extension o Work with Teacher • 1st: High group ("Eagles") o What does the equal sign mean? o replace a number with an 'x' • 2nd - Middle group ("Pigs"--target group for lesson study) o What are you noticing? o Why does this work? o Is it always true? o How can you use this in daily life? o Subtraction facts - addition facts link o Does knowing that - + - is -- help you with a subtraction fact? • 1st - Low group ("Whales") o Guided practice with game o What are we noticing? o Why does this work? o Is it always true? o How can you use this in daily life / math? Closure & Wrap-up (5-10 minutes): Exit Ticket Preview to Fact-Family Rap, "Related and I *Know* It" ?	work with partners to identify and record fact families; three related numbers are given and students create the four equations. o Algebra Extension: cover one number with a 'dot' • Teacher Station (15 minutes) • Tenmarks (15 minutes) Closure & Wrap-up (5-10 minutes):

The team's lesson plan demonstrates an understanding of MME. Their decision to incorporate choice, challenge, and interest demonstrates their efforts to incorporate UDL design principles. Although the team was directed to plan instruction that incorporated elements of MME, they also planned for instruction that met MMAE and MMR principles, as evidenced by their differentiated "fact family" centers and the exit ticket that asks students to reflect on their learning.

All of the participants engaged in a lesson study based on the model developed by Hurd & Lewis (2005). The lesson study provided a fidelity measure to assess the degree to which participants were able to transfer what they learned during professional development as well as support the self-regulation of instructional skills. Lesson studies developed by the participants demonstrated evidence of: (1) forethought, planning, and activation; (2) monitoring; (3) control; and (4) reaction and reflection (Pintrich, 2005). Participants actively engage in this process as they returned to their SMART goals during each meeting.

The presence of instructional strategies designed around MME in classrooms during classroom observations was high. Although participants were asked to incorporate design principles form the MEM framework as they planned their lessons in teams, there were no directives given by the principal to incorporate UDL into daily instruction despite it being a desired outcome. The observation protocol (see Appendix H) was used to determine the presence of UDL principles during observed instruction. The following table (see Table 15) reflects the frequency with which these design principles were observed during instruction (n = 24). One observation was conducted in each participants' classroom in order to maintain the integrity of collective bargaining agreements.

Table 15. Presence of UDL features implemented during observed instruction.

UDL Checkpoint	Number of Times Observed During Instruction (n = 24)
7.1 Provide options for recruiting interest: optimize individual choice and autonomy	18
7.2 Provide options for recruiting interest: optimize relevance, value, and authenticity	14
7.3 Provide options for recruiting interest: minimize threats and distractions	22
8.1 Provide options for sustaining effort and persistence: heighten salience of goals and objectives	13
8.2 Provide options for sustaining effort and persistence: vary demands and resources to optimize challenge	19
8.3 Provide options for sustaining effort and persistence: foster collaboration and community	20
8.4 Provide options for sustaining effort and persistence: increase mastery oriented feedback	18
9.1 Provide options for self-regulation: promote expectations and beliefs that optimize motivation	18
9.2 Provide options for self-regulation: facilitate personal coping skills and strategies	19
9.3 Provide options for self regulation: develop self-assessment and reflection	15

These observations were conducted independent from the lesson study process, as both a fidelity measure and a way to determine to what extent participants transferred their learning. Among the most common principles observed, minimizing threats and distractions, varying demands and resources to optimize challenges, fostering collaboration and community, and facilitating personal coping skills and strategies had the highest presence. Fostering collaboration and community may be connected to the PBL planning that took place since participants were

exposed to the 4C's (communication, creativity, collaboration, and critical thinking) and made deliberate attempts to incorporate this into instruction. Participants received feedback that targeted MME after observations were conducted.

By engaging in the lesson study process, participants developed a research question and designed a SMART goal related to the team's topic of interest during the first phase of the lesson study. During the second phase of the lesson study, participants researched their question of interest and developed a lesson using their knowledge. These lessons required participants to identify their lesson theme and its connection to the standards, write a rationale, identify student assessments, and connect the lesson to UDL design principles. During phase three of the lesson study, one participant delivered the lesson to a group of students while colleagues observed the lesson using a lesson study observation protocol (see Appendix H). In some cases, one participant delivered the lesson to a different class other than her own, while some teams observed one lesson and every one else attempted it. During the final phase of the lesson study, participants debriefed the lesson, identified adjustments to practice and developed a revised lesson to be delivered in the classroom.

The frequency with which participants made adjustments to instructional practice between phases three and four of the lesson study cycle were measured using the Teacher Lesson Plan Review Protocol (see Appendix I). Each team of participants submitted one set of lesson plans that were assessed using the protocol ($n = 5$). The table below reflects the number of adjustments that teams made between their first and second lessons, in conjunction with lesson studies.

Table 16. Adjustments to instructional practice (during lesson study), based on feedback from peers.

Number of Adjustments to Practice	Number of Teams That Made Adjustments (n = 5)
None	n/a
1 or more	3
2 or more	2

The participants in this study made adjustments to practice based on their assessments of student learning. All of the lesson study teams used a common template for writing their revised lesson. A sample lesson plan revision, crafted by the same team found in Table 14, can be found below (see Table 17).

Table 17. Sample lesson revision.

1. Title of the lesson: They're Related and You Know It, Part 2

2. Research theme (Long-term Goals), Broad Subject Matter Goals, Lesson Goals, Standards, and Objectives:

Research Theme: Repetition in Multiplication and Division

Broad Subject Matter Goals: Understanding and leveraging reciprocal relationships while solving division problems

Lesson Goals: Students see and use the reciprocal relationship in multiplication and division in order to solve division problems, just as when students were faced with comparable tasks in addition and subtraction.

Standards:
Mathematical Standard 8: Look for and Express Regularity in Repeated Reasoning

Objectives:
Students will notice repetition in multiplication and division problems
Students will discover shortcuts and generalizations for solving division problems

3. Lesson Rationale: Why we chose to focus on this topic and goals. For example, what is difficulty about learning/teaching this topic? What do we notice about students currently as learners? Why we designed the lesson as shown below.

The team chose this topic because the reciprocal relationships between addition and subtraction, as well as multiplication and division, are critical patterns for third graders to grasp. Students are missing the conceptual understanding behind reciprocal operations and fact families. They do not use addition to understand or solve subtraction and vice versa; we notice the same patterns with multiplication to solve division. We are working to use multiple media to support students' comprehension of the reciprocal relationship between division and multiplication.

4. Data collection points during the lesson observation.

Our team will collect data on: applied understanding of reciprocal relationships and fact families as evidenced by the exit ticket, small group teacher observation and note-taking, as well as reviewing work completed in pairs/individually in centers. Our ultimate objective is that the data collected during mid- and end-of-year assessments will show improvement (specifically, 85% proficiency across the grade).

5. Connection to Universal Design for Learning Principles.

How will you address affective brain networks? The affective brain networks largely deal with the 'why' of learning; we strive to provide an engaging learning opportunity for students. Our initial goals are that students have some level of choice, are challenged, and are interested in the work.

a. **Choice:** Students will be able to choose what to take pictures of and how to show their multiplication/division representations.

b. **Challenge:** Students may find different representations of multiplication or division around the school. They may challenge themselves based on their readiness.

c. **Interest:** Facts are not, in-and-of themselves, particularly interesting. Multiple modes of representation and expression (technology--photos and screen chomp app) will increase students' interest.

6. Connection to CCSS Math Practice Standards (List which math practice standards you're using):

CCSS.Math.Practice.MP1: Make sense of problems and persevere in solving them.
CCSS.Math.Practice.MP2: Reason abstractly and quantitatively.
CCSS.Math.Practice.MP7: Look for and make use of structure.
CCSS.Math.Practice.MP8: Look for and express regularity in repeated reasoning.
CCSS.Math.Content.3.OA.D.9: Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.

7. Which of the following tier-2 math practice standards will you implement to reach struggling learners?

Teaching numbers and operations using a developmental progression.	Teaching geometry, patterns, measurement, and data analysis using a developmental progression.	Using progress monitoring to ensure that math instruction builds on what each child knows.	Teaching children to view and describe their world mathematically.
Dedicating time each day to teaching math, and integrate math instruction through the school day.	Screening all students to identify those at risk for potential mathematical difficulties.	Providing interventions for students at risk.	Providing interventions that focus intently on in-depth treatment of whole numbers.
Providing explicit and systematic instruction. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.	Providing interventions that include instruction on solving word problems based on common underlying structures.	Providing interventions that include opportunities for students to work with visual representations of mathematical ideas.	Providing strategy-based interventions to support building fluent retrieval of basic arithmetic facts.
Monitoring the progress of students receiving supplemental instruction and others who are at risk.	Incorporating motivational strategies for students receiving tier-2 and tier-3 instruction.		

What is the teacher doing?	What are the students doing?
1. Mini Lesson: (10 minutes) 2. Activate background knowledge (Last time we talked about the relationship between addition and subtraction…) 3. Today we're going to focus on the connection between multiplication and division 4. Explain small group activity (Screen Chomp) & expectations. 5. Show example & ask "What could this muppet add to their work to make it even better?" (A: the other multiplication equation to complete the fact family). 6. Brainstorm places to go & things to look for 7. Small Group Activity: (30 minutes) 8. Break off into heterogeneous groups (4 students with each adult) 9. Find examples of multiplication or division around the school 10. Take a picture and show or say the multiplication and division equations; record voice explaining the relationship 11. Exit Ticket: (10 minutes) 12. Explain directions for exit ticket; activate background knowledge (i.e. making arrays & labeling dimensions on "arranging chairs" posters)	1. Mini Lesson 2. Students are actively listening to the review of the last lesson study and to the directions for today's activity 3. Small Group Activity: (30 minutes) 4. Break off into heterogeneous groups (4 students with each adult) 5. Find examples of multiplication or division around the school 6. Take a picture and show or say the multiplication and division equations; record voice explaining the relationship 7. Exit Ticket (10 minutes) 8. Students complete exit ticket independently

Team Reflection Notes:

- Exit Ticket: question #2 indicated whether students met the benchmark (i.e. providing a multiplication equation to help solve division)
    - 10/20 → totally met benchmark; 2/20 → intervention; 8/20 → unknown (didn't follow directions)
- Modification for future planning: clarify directions on #2 (i.e. provide ____ X ____ = _____)
- Some kids took pictures of uneven arrays (i.e. one row with 6 items, one row with 4 items) → when teacher asked them about it, they caught their mistake and fixed it
- Future Center work: give students items, ask them to separate them into equal groups, then provide the division equation
    - Noticed most kids started with multiplication equations, and division is still being seen as more challenging for them
- Students thoroughly enjoyed the activity, using "Screen Chomp" and working in small groups with teachers!
- Shift activity focus to help students answer the question: How can you use multiplication to help you solve a division problem?
- Future Activity: give students a number (whole) & tell them to find the array/picture that works & incorporate fact families
    - Haiku Deck

This lesson plan illustrates adjustments to instructional practice, as well as the participants' mastery of self-regulation. It demonstrates (1) forethought, planning, and activation (i.e. participants worked towards achieving a specific goal); (2) monitoring (i.e. participants built assessments of learning into the design); (3) control (i.e. careful consideration is given to what the teacher is doing and what the student is doing); and (4) reaction and reflection (i.e. although the team was not prompted to write a reflection after the "re-teach" lesson, they chose to do so). An area of future study would be to determine the degree to which participants continue to implement, extend, or refine instructional strategies employed during the lesson study. This could be measured by conducting observations after participants were exposed to the intervention.

Conclusions

One of the key findings is that the UDL framework is complex and may take years of study and practice in order for teachers to demonstrate mastery of the design principles. Similar findings were articulated by Edyburn (2010) who argued that UDL is "much more complex than we originally thought" and that "defining UDL as a subfield within instructional design will provide a knowledge base that is more relevant than looking to architecture for insight" (p. 40). Some studies indicate that teachers may need as many as 50 hours of practice with a strategy in order to achieve mastery (Gulamhussein, 2013). The vast majority of participants indicated that they wish they had more time to learn about UDL, design instructional practices using the framework, and implement these methods in the classroom.

There was also high level of variability in how teachers explored the research questions associated with their lesson study goals though participants attributed collaboration with their colleagues as one of the successes of the intervention. This support's Eun's (2008) argument

that professional development should be grounded in the developmental theories of Vygotsky. As Eun (2008) asserts "social behavior is never performed by an individual in a vacuum" and mediation is the mechanism that underlies these interactions (p. 137-138). Individuals experience mediation "through material tools; mediation through symbolic systems; and mediation through another human being" (Eun, 2008, p. 137). In this context, participants served one another, the UDL framework served as a symbolic system, and the lesson study process provided participants with the material tools they needed to accomplish their goals.

Time was one of the most commonly referenced areas for improvement. Several of the participants in the study reported that they felt they needed more time to plan for instruction. During focus groups, they reported that they felt they needed more time with the UDL framework. One team suggested that one aspect (such as multiple means of action and expression) be a year-long focus for all professional development.

Future Implications

Although the study was constrained by factors such as time, a goal-driven professional development model may be utilized in learning organizations outside of the field of education. For example, it could be applied in institutions of higher education or within any organization where professional learning is required in order to perform the essential functions of the job.

While the study was implemented in a learning context that the student investigator knew well, it can be replicated in a number of other contexts such as elementary, secondary, or post-secondary settings. The participants who engaged in this study had high levels of trust which is critical to the success of conducting a lesson study. However, in learning contexts where there may be less trust or higher attrition rates, teachers may consider conducting a lesson study with a group of "critical friends." Instructional leaders might also consider identifying staff members

who could collaborate together to conduct a pilot lesson study that could be used as a model for other educators within their learning organization.

Furthermore, instructional leaders who are considering training teachers in UDL should develop a multi-year strategic plan for training, given the complexity of the framework and the number of design principles. While participants did respond positively to the intervention and self-reported higher levels of self-efficacy in delivering instruction designed around the framework's principles, several participants reported that they felt that the framework had "too many things" to remember and articulated that some of the design principles are "just good teaching practice." While UDL features were present in curriculum, instruction, and assessment throughout the lesson study process, teachers utilizing this framework might feel less overwhelmed by the framework if they were to receive several hours of coaching on one aspect of the framework over the course of an entire school year so that they could attempt to utilize the design principles when planning across the curriculum.

UDL methods can and should be utilized in any learning setting. Schools of education responsible for training and preparing teachers as well as principles might consider utilizing this instructional framework in order to guide the implementation of instructional practice in the classroom. This should go beyond exposing educators to the framework through a textbook. Professors and supervising practitioners should consider modeling these practices during classroom instruction and might also consider how they can encourage learning transfer by requiring teachers to put these methods into practice when participating in practicum experiences. This could be achieved by structuring assignments where educators are asked to make explicit connections and by designing accountability systems to ensure that this happens. This means going beyond asking educators to write papers about their experiences. Instead

practicum supervisors might offer more instructional coaching or design opportunities for educators within the higher education classroom to conduct their own lesson studies where pre-service teachers and observe one another teaching young learners. The same principles of design could also be applied to principal training programs where instructional leaders are supervised by professors and supervising practitioners. Instead of applying UDL instructional methods to the classrooms, instructional leaders might receive training in how to observe teaching and learning through the lens of UDL, provide feedback, and design and develop trainings for educators by utilizing its design principles.

Areas for Future Study

Although the professional development sequence did achieve most the expected outcomes, there are several areas that warrant further study. Given that participants reported higher levels of self-efficacy in providing options for comprehension by maximizing transfer and generalization, further investigation into the extent to which the intervention helped participants transfer and generalize their own learning is warranted. Understanding how and why participants reported higher levels of efficacy on this measure is integral to understanding the efficacy of the intervention and its design. It would also be beneficial to study the degree to which the participants' professional learning and self-regulation transfers to their students. Such a study would have to be conducted longitudinally in order to assess student growth over time.

Timing plays a tremendous role in how the participants in this study perceived their jobs. During focus groups, several participants explained that they wish they had more time to digest their learning, and more time to plan for instruction using evidence-based strategies. Therefore, the allocation of time for training, development, and coaching could be adjusted based on the

participants' feedback. While focusing school-wide curriculum, faculty, and data meetings provided the instructional leader with the opportunity to deliver the same message to all educators, more time should be spent on coaching teachers after observations of teaching and learning. In order to promote a deeper understanding of UDL principles, instructional coaching around one design principle at a time may be needed. Such coaching could lead to even greater feelings of self-efficacy in planning evidence-based instruction.

Professional development time is often a one-size fits all approach based on the majority of faculty learning needs. Fiscal resources, education policy mandates, and collective bargaining agreements often influence the way(s) in which professional development is implemented. Personalizing learning for teachers, however, is imperative if we want to make an impact on teachers' instructional skills. With the growing number of open source programs, and technology-based tools, however, instructional leaders might consider how they can provide teachers with opportunities for differentiation by blending professional development. If given the opportunity to conduct the intervention again, modules would be created based on teacher needs and professional development would be delivered differentiated through a blended format. Teachers feel most engaged when they can learn in their zone of proximal development (Klein & Riordan, 2009) and can self-regulate their own learning. Teachers would be responsible for completing different modules, based on their SMART instructional goals. These modules would be designed by the school's instructional leader. Whole school meetings would be limited to meetings when the entire faculty must be present together. District-trainings, communication about policy mandates, and exhibitions of teacher learning would be the only reason to bring the entire faculty together. Face-to-face time would be spent in teams and faculty and curriculum meeting times collectively bargained would be spent in smaller lesson study teams that are

committed to exploring their research questions. This would also let the instructional leader spend more time facilitating the lesson studies of the teachers and supporting their lines of inquiry. Although this would require more time from the school's instructional leader, it could help to maximize the efficiency of instructional coaching.

Appendix A

Instructional Practice Survey

Author's Note: *The aims of this study changed after data from instructional practice survey was analyzed.*

Instructional Practice Survey

Target Audience: All elementary teaching faculty in the public elementary schools.

Goal: You are being asked to participate in this survey because you are a teacher or administrator in the district. The purpose of this survey is to understand attitudes and perspectives about the following aims (see table below). Information will be used to unify our collective vision for technology integration and pedagogy in our elementary schools.

Aim 1: To understand teacher perceptions about their level of preparedness in meeting the needs of 21st century learners.
Aim 2: To understand teacher perceptions about learning and its role in promoting deeper levels of cognitive engagement.
Aim 3: To understand how the current instructional practices do/do not support the acquisition of executive skills.

Collection Method: Survey Monkey (in Moodle)

Time Commitment: The survey will require about 15 minutes of your time. Your responses will be kept confidential.

Background

In what building do you currently teach? ***(PD)***

- School C
- School B
- School E
- School A

- School D

For how long have you been teaching? ***(PD)***
- 0-2 years
- 3-4 years
- 5-6 years
- 7-8 years
- 8-9 years
- 10+ years

For how long have you been teaching in (at least) one of the elementary schools here? ***(PD)***
- 0-2 years
- 3-4 years
- 5-6 years
- 7-8 years
- 8-9 years
- 10+ years

What is your highest level of education? ***(PD)***
- Bachelor's Degree
- Master's Degree
- Certificate of Advanced Graduate Studies (CAGS)
- CAGS + Master's
- Doctorate

How frequently do you engage in programs or activities to support your own professional development (outside of opportunities provided by the district)? ***(PD)***
- 0 times a year (district/school provides all of your professional development)
- 1 times/year (this may a course, a conference, a workshop, etc)
- 2 times/year (2 courses, conferences, workshops, etc.)
- 3+ times/year (3 or more courses, conferences, workshops, etc)

From whom or from what source do you learn best? ***(PD) – check all that apply***
- colleagues inside district
- colleagues outside of district
- workshops/conferences
- courses (i.e. runs over the course of multiple weeks)
- professional journals and other publications

Open-Ended Questions

How do you define learning? (50 words or less) ***(AIM 2)***

How do you define student engagement in the classroom? (50 words or less) ***(AIM 3)***

How do you define academic rigor? (50 words or less) ***(PD)***

Check All That Apply/Multiple Choice

If the district brings more mobile devices into our classrooms, in what areas do you feel you would need the most support and professional development? (check all that apply) ***(PD)***

- applications for the classroom
- how to use an iPad (how to navigate the device and its software)
- station rotations in a blended learning environment
- managing digital workflow (on the iPad)
- managing the classroom (how best to manage devices)
- how to use technology in conjunction with "intervention" plans
- how to use technology to provide students with feedback
- how to use technology to collect, analyze and disseminate learning assessments

Based on what you see below, what do you believe is the highest priority in creating a 21st century learning environment? (check only one) ***(AIM 2)***

- How to use technology responsibly [digital citizenship]
- The science of how we learn, construct meaning, and engage with the world [cognitive engagement]
- How to consume, use and produce technology [digital literacy]

How prepared do you feel to help our students become 21st century learners? (check only one) ***(AIM 1)***

- I've been waiting for this -- bring it on!
- I'm prepared, but I need a little help
- I do not feel prepared but I'm ready for it
- Other:

How many courses have you taken over the course of your career online or in a "hybrid" format? ***(PD)***

- 0
- 1-2
- 3-4
- 5-6
- 7+

How frequently do you read texts in electronic formats (i.e. on an e-reader, laptop, etc)? ***(PD)***

- never (I try to avoid it at all costs)
- seldom (I only read texts in e-form when I have to)
- often (I read on an e-reader as often as I can)
- all of the time (my preferred format is digital)

Rating Scales (i.e. ordinal data)

Rate the degree to which you agree/disagree with the following statements:

1 - I do not know what this is.
2 - I heard of this but I'm not sure what it is.
3 - I'm not sure how to answer this question.
4 - I have some knowledge about this but would need a lot of support with implementation.
5 - I know what this is and could implement this/am currently implementing this.

1. I know what **blended learning** is. ***(PD; AIM 3)***
2. I am familiar with a **station rotation** model and can design a learning environment where students use 5-8 electronic devices at a time. ***(PD; AIM 3)***
3. I am familiar with **Understanding By Design** and use this model to guide my daily instructional practice. ***(PD; AIM 3)***
4. I am familiar with **Universal Design for Learning** and use this model to guide my daily instructional practice. ***(PD; AIM 3)***
5. I know how to implement a **project-based learning** (PBL) model for learning and incorporate PBL as often as possible. ***(PD; AIMS 1 & 3)***
6. In my teaching practices, I know how to successfully integrate: ***creativity and innovation. (PD; AIM 1)***
7. In my teaching practices, I know how to successfully integrate: ***critical thinking and problem solving. (PD; AIM 1)***
8. In my teaching practices, I know how to successfully integrate: ***higher-order questioning techniques. (PD; AIM 1)***
9. In my teaching practices, I know how to successfully integrate: ***metacognitive practices. (PD; AIMS 1 & 3)***
10. In my teaching practices, I know how to successfully integrate: ***communication and collaboration. (PD; AIM 1)***
11. In my teaching practices, I know how to successfully integrate: ***media literacy. (PD; AIM 1)***
12. In my teaching practices, I know how to successfully integrate: ***ICT (information, communications and technology) literacy. (PD; AIM 1)***
13. In my teaching practices, I know how to successfully design opportunities for students to learn: ***initiative and self-direction. (PD; AIMS 1 & 3)***
14. In my teaching practices, I know how to successfully design opportunities for students to learn: ***social and cross-cultural skills. (PD; AIM 1)***
15. In my teaching practices, I know how to successfully design opportunities that promote and encourage: ***productivity and accountability. (PD; AIM 1)***

16. In my teaching practices, I know how to successfully integrate: ***leadership and responsibility. (PD; AIMS 1 & 3)***
17. In my teaching practices, I know how to successfully help children to: ***self-regulate. (PD; AIMS 1 & 3)***
18. In my teaching practices, I know how to successfully create: ***opportunities for children to develop their own goals, works towards meeting them, and adjust when they are not meeting them. (PD; AIMS 1 & 3)***
19. In my teaching practices, I know how to successfully create: ***opportunities for the transfer of knowledge. (PD; AIMS 1,2,3)***
20. In my teaching practices, I know how to successfully create: ***opportunities for children to be flexible and adapt to their learning environment. (PD; AIMS 1 & 3)***

Appendix B

Johns Hopkins University
Homewood Institutional Review Board (HIRB)

Letter of Informed Consent

Title:	Cognitive Engagement: Examining the Impact of Technology to Support 21st Century Learning and Executive Function
Principal Investigator:	Heather L. Brennan Smith, Doctoral Student, Johns Hopkins University
Date:	11 April 2014

Purpose of Research Study:
The purpose of the present needs assessment is to understand teacher attitudes and perceptions about 21st century learning and the role of executive skill learning. More specifically, the data will inform the present efforts to provide professional development that addresses the needs of teachers in the school district. By completing this survey, you are consenting to be in this research study. Your participation is voluntary and you can stop at any time.

Procedures: Time required: You will be asked to complete the survey; the survey should take about 15 minutes.

Risks/Discomforts: There are no anticipated risks associated with this study.

Benefits: There is no direct benefit to you for participating. However, information gained from this survey will provide information that may inform future professional development efforts within the district related to 21st century learning, executive function, and technology.

Voluntary Participation and Right to Withdraw: Your participation in this study is entirely voluntary. You choose whether to participate and will indicate below whether you agree to take part in the study. If you decide not to participate there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

You can stop participation in the study at any time, without any penalty or lost benefits. If you want to withdraw from the study, please contact Heather Smith (508) 647-6570 or via email at hsmith@natickps.org or you can contact my professor, Dr. Melissa Murphy at (443) 610-2455 or via email at mpavett1@jhu.edu

Confidentiality: Surveys will be collected in digital format. All research data including paper surveys and observation results will be kept in a locked office. Electronic data will be stored on

the PI's computer, which is password protected. Any paper files will be shredded, five years after collected.

All measures will be examined by the Principal investigator, and research affiliates only (including those entities described above). No identifiable information will be included in any reports of the research published or provided to school administration. A participant number will be assigned to all surveys.

Any study records that could identify you will kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the office for Human Research Protections (all of these people are required to keep your identity).

Compensation: You will not receive compensation for participating in this study.

Questions or Concerns: You can ask questions about this research study at any time during the study by contacting Heather Smith via phone or email: (508) 647-6570 or at hsmith@natickps.org

If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

Signatures (What Your Signature Means):
Your signature below means that you understand the information in this consent form. By signing this consent form, you have not waived any legal rights that you are entitled to as a participant in a research study.

_____

(Your Signature) Date

_____

Signature of Person Obtaining Consent Date
(Investigator or HIRB-Approved Designee)

LOGIC MODEL: CULTIVATING SELF-REGULATED LEARNING FOR TEACHERS THROUGH TRAINING IN MULTIPLE MEANS OF ENGAGEMENT

Intervention Inputs/Activities

PROFESSIONAL DEVELOPMENT

Content Focus: Teacher training on UDL framework with emphasis on multiple means of engagement and affective networks (2 hour training at beginning of school year)

Active Learning: Analysis of teaching and learning through peer observation during lesson study in grade-level teams

Coherence: Training commensurate with School Improvement Goal, District-Goals, and State Policy on Educator Evaluation

Duration: 2 hours of UDL training from CAST, 6 hours of embedded professional development designed according to UDL principles of MME, 1,200 minutes of direct teacher observation through announced and unannounced walkthroughs, 400 minutes of reflection on SMART goals & self-assessments, 8 hours of PLC time devoted to collaboration

Collective Participation: 100% of teaching staff exposed to UDL professional development

SUPPORT

- Principal Evaluations of teaching and learning with mastery-oriented feedback on MME
- Peer observation through lesson study

MATERIALS

- TeachPoint accounts for educator evaluations, reflections, and self-evaluations
- UDL training materials (from CAST)

Mediators (Fidelity of Intervention)

SMART Goals: Develop SMART goals with the aim of improving professional practice

Self-Assessments: Reflect purposefully upon one's own teaching practice through educator self-assessment and develop plan to monitor progress towards meeting goals

Instructional Planning: Design lessons that incorporate design principles of MME

Reflection: Reflect purposefully upon one's own teaching practice; provide reflections upon MME after unannounced and announced walkthroughs

Adjustment to Practice: Make adjustments to practice based on reflections, mastery-oriented feedback, and/or peer observation

Knowledge of Affective Brain Networks: Develop knowledge-based about affective networks in the brain and develop instructional strategies for meeting the needs of diverse learners

Outcomes

Goal-setting: Writing measurable and achievable goals that correlated to instructional practice, monitoring progress towards meeting them, and adjust strategies as needed

Mastery of UDL principles: Application of UDL principles in instructional planning

Adjustment to Practice: Develop knowledge of how to adjust instructional practice based on reflections, mastery-oriented feedback, and/or peer observation

Self-Efficacy: Increase in feelings of self-efficacy and positive self-core evaluation. Increased confidence in the explicit instruction of self-regulated learning strategies, purposeful reflection of self, facilitation of personal coping skills

CONTEXT

Student Characteristics: 100% of students referred for tier-2 and tier-3 instruction have Executive Functioning deficits; SRL identified as key 21st century skill

Teacher Characteristics: Prior experience, content knowledge, beliefs about self, and attitudes (Kang, Cha, & Ha, 2013)

Principal Leadership: Implementation designer, evaluator, and teacher coach

School Culture: District and building-based Professional Learning Community structures

Curriculum, Instruction, & Assessment: Coherence between professional development and instructional materials used in classroom

Appendix D

Professional Development Sequence

August 31 District Opening Day!	Opening Day Intros Evaluation Break-outs/DDM Discussions??? Explain new DDM Pathway ELERTS training (All)
September 1 Building Day!	8:00-8:30 Breakfast 8:30-11:00 Welcome Back to Our Community! Framing the Year • Deeper Learning • Universal Design for Learning • Assessing Your PD Needs Lesson Study: Overview • Form Teams • Developing Norms • Thinking About Your Research Question & Smart Goals PBIS Year 3: It keeps getting better! Nuts & Bolts • Lilja Folder (in Drive) • Office Procedures **SEB, Health, and IEP Consults PM (see schedule)
September 21 ER: 1:15-3:45	Review of PLCs & Goal Setting Making Sense of DDM Data and Using Student Survey Data to Set goals (I hour)
September PLC Tasks	work on establishing SMART goals (at least one goal should relate to your Research Lesson & some aspect of UDL) -- goals due by October 15th
October 5 (FM/CM)** 3:05-5:05	1. Celebrations & Announcements (5 minutes) 2. PBIS Questions? (5 minutes) 3. A Quick 4. Survey (10 minutes) 5. Introduction to UDL (35 minutes) 6. Lesson Study Cycles: Our Work Begins! (60 minutes)
October 6th & 9th	Framing the Big Picture: Assessment in Perspective

Data Team Meetings	Triangulating the Data: Identify Needs & Develop Flexible Groups Lesson Study: Researching & Writing Your Research Lesson
October 28 ER: 1:15-3:45	K PLC STEAM with Claudia Price K-4 STEM overview/Kick off/reading/activity (update on math computation/prob solv committee and sci planning and curric workshops)
October PLC Tasks**	Work on goal-setting (note: goals should be connected to district & school improvement plans)
November 2 (FM) 3:05-4:05	Framing the Big Picture: Assessment in Perspective DDMs: Score & Calibrate
November 16 (CM) 3:05 - 4:05	DDMs: Score & Calibrate Specialists: Review of accommodations for students on IEPs, 504s, RTI
November PLC Tasks**	DDMs: Score & Calibrate
Natick's Innovation & Design Summit -- November 30 All Day!	Big ideas/Go Math
December 7 (FM & CM)** 3:05-5:05	Lockdown Debrief Vertical Conversation: Math Fact Fluency K-4 Lesson Study Planning
December PLC Tasks	Finish writing your research lesson & implement it with your team
January 4 (FM) 3:05-4:05	PBIS Update (5-10 mins) UDL Case Study: Strategic Networks & Multiple Means of Action & Expression Lesson Study & Vertical Team Time: Connecting lesson study to UDL
January 12 ER: 1:15-3:45	PLC DDM 1 scoring should be complete and in spreadsheet for at least one administration PLCs update spreadsheets to reflect all Common Assessment data

	K-4 ready mid-year math assessments MS Learning Center and ACCESS Together with Ives
January 25 (CM) 3:05-4:05	UDL Case Study: Strategic Networks & Multiple Means of Action & Expression Lesson Study: Connecting lesson study to UDL
Data Meetings February 1: Grade 4 February 3: Grade 3 February 12: Grade 2 February 4: Grade 1 February 23: Kindergarten	Part I: Identify Individual Student Needs & Flexible Groupings Part II: Looking at classroom and grade level trends Part III: Instructional Planning & Adjustments to Instructional Practice Part IV: Lesson Study (1 hour)
January PLC Tasks**	Conduct research lessons (to be scheduled)
February 1 3:05-5:05	1. Homework/Recess Policy: What are some alternatives to taking away recess? 2. UDL: Multiple Means of Engagement 3. RtI Primer: How does UDL support students across tiered levels of instruction? 4. RtI Case Study & Mock RtI teams
February 2 ER: 1:15-3:45 (2.5 hours)	Building-base: Looking at Student Work (comprehensive literacy assessments)
February 22 3:05-3:35	Blended Learning Survey
February PLC Tasks**	Continue working on your research lessons
March 1 ER: 1:15-3:45	PLC (district-wide)
March 7 (FM & CM)** 3:05-4:35	UDL Case Study: Multiple Means of Engagement through Project-based Learning (90 mins)
TBD	Guided Access Training for PARCC Proctors
March PLC Tasks	Reflect on Lesson Studies

Appendix E

Oral Consent

Johns Hopkins University
Homewood Institutional Review Board (HIRB)

Informed Consent Form

Title:	**Supporting Teachers' Self-Regulated Learning Through Professional Development**
Principal Investigator:	*Heather L. Brennan Smith, Johns Hopkins University, Doctoral Student, Mind, Brain, and Teaching*
Date:	*20 November 2015*

PURPOSE OF RESEARCH STUDY:

The purpose of this research study is to help teachers develop a cadre of efficient strategies for helping students learn by incorporating brain research and developments in the field of cognitive psychology into their professional practice. If we want to provide students with meaningful and engaged opportunities for learning that support the acquisition of deeper learning skills, we must support teachers in refining their instructional practices. New pedagogy, however, requires new ways of thinking about teacher professional development. The goal of the present study is to investigate the relationship between professional development, teacher self-regulated learning, and teachers' feelings of self-efficacy.

We anticipate that approximately *24* people will participate in this study.

PROCEDURES:

Teaching faculty will be asked to attend a series of professional development workshops, designed to support teachers' self-regulate learning and provide teachers with a greater understanding of the learning sciences. This professional development sequence will be designed by the student investigator, who is also the Principal of the school in which the study will be conducted. The proposed intervention will follow the principles of an interrupted time series design with pre-assessments and post-assessments administered before and after treatment. Observations will be conducted during the intervention period and focus groups will be conducted after the teachers have been exposed to treatment. Program outcomes will be assessed according to four indicators: (1) goal-setting; (2) instructional practices guided by Universal Design for Learning; (3) instructional planning; and (4) teacher feelings of self-efficacy.

RISKS/DISCOMFORTS:

There are no risks associated with participation in this study.

BENEFITS:

There are no direct benefits to you from participating in this study.

This study may benefit society if the results lead to a better understanding of the professional learning of teachers and how to best implement Universal Design for Learning.

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:

[This will be stated to participants, verbally]

As you know, I am working on my doctorate in Mind, Brain, and Teaching. Although the lesson studies, professional development, and data collection are part of our normal everyday practice, I would like to write about your experience in my dissertation in order to help other instructional leaders. You may choose whether or not you would like your experience captured in this study through my dissertation. All names will be removed from my notes and pseudonyms will be used.

Your participation in this study is entirely voluntary. You choose whether to participate. If you decide not to participate, there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

If you choose to participate in the study, you can stop your participation at any time, without any penalty or loss of benefits. If you want to withdraw from the study, please let me know and I will not include your feedback in the study.

If there is any new information during the study that could affect whether you want to continue participating, I will discuss this information with you.

ALTERNATIVES TO PARTICIPATION:

Given that our participation in the professional development sequence and activities associated with it are part of our normal practice, all teachers will participate in the activities. However, if participants choose not to be a part of the study, their information and feedback will be removed from all notes included in the dissertation.

CONFIDENTIALITY:

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the National Institutes of Health and the Office for Human Research Protections. (All of these people are required to keep your identity confidential.) Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

All data will be maintained separately from any identifying information by assigning participants with a number. This number will be stored on the student investigator's computer which is locked with a passcode. These records will be maintained until the data are accurately recorded. Once the data are used, all files will be permanently deleted.

COMPENSATION:

Teachers will not receive any additional compensation for their participation in the study. However, time to participate will be built into regularly scheduled professional development activities and meetings.

IF YOU HAVE QUESTIONS OR CONCERNS:

You can ask questions about this research study now or at any time during the study, by talking to the researcher(s) working with you or by calling Heather Smith (774-270-0750) or my adviser, Mary Ellen Lewis, (443) 923-7822.

If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

IF YOU ARE HARMED BY PARTICIPATING IN THE STUDY:

If you feel that you have been harmed in any way by participating in this study, please call Heather L Brennan Smith, Principal, at (774) 270-0750 or Mary Ellen Lewis, Adviser, at (443) 923-7822. Please also notify the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

Appendix F

Teacher SMART Goal Protocol

Teacher SMART goals will be reviewed using this protocol, designed to measure the alignment between the teacher's professional practice SMART goal and the lesson study.

Is the teacher's SMART goal related to the school improvement plan and the targeted research question for lesson study?	
Present	Not Present

Appendix G

Lesson Study Planning

Team Member:
Instructor:
Date:
Grade Level:

1. Title of the lesson.

2. Research theme (Long-term Goals), Broad Subject Matter Goals, Lesson Goals, Standards, and Objectives.

3. Lesson Rationale: Provide a rationale for your choice of a target topic and goals and lesson design. For example, what is difficulty about learning/teaching this topic? What do we notice about students currently as learners in relation to this topic?

4. Data collection points during the lesson observation.

    1. Our team will collect data on:

5. Connection to Universal Design for Learning Principles:

    1. How will you address affective brain networks?

What is the teacher doing?	What are the students doing?

Appendix H

Teacher Observation Protocol

The following protocol will be used to assess the presence of professional development features in instructional practices. The same protocol will be used at least once for each teacher. Each observation will take place for approximately 45-60 minutes.

Participant Name/Number	
Grade Level	Kindergarten Grade 1 Grade 2 Grade 2 (co-taught) Grades 1-2 (multiage) Grade 3 Grade 3 (co-taught) Grade 4 Grade 4 (co-taught) Grades 3-4 (multiage) ACCESS (sub-separate setting for children with Autism Spectrum Disorder)

Does the teacher demonstrate evidence of the following?

UDL Checkpoint	***Observed?***	***Not observed?***
1. Providing students with multiple means of engagement.		
2. Promoting representational networks in the brain.		
3. Promoting affective networks in the brain.		
4. Providing students with multiple means of action and expression.		
5. Promoting strategic networks in the brain.		
6. Providing opportunities for self regulation: promoting expectations and beliefs that optimize motivation.		
7. Providing opportunities for self regulation: facilitating personal coping skills and strategies.		
8. Providing opportunities for self regulation: developing self-assessment and reflection.		

9. Providing opportunities for sustaining effort and persistence: heightening salience of goals and objectives.		
10. Providing opportunities for sustaining effort and persistence: varying demands and resources to optimize challenge.		
11. Providing opportunities for sustaining effort and persistence: fostering collaboration and community.		
12. Providing opportunities for sustaining effort and persistence: increasing mastery-oriented feedback.		
13. Providing opportunities for recruiting interest: optimizing individual choice and autonomy.		
14. Providing options for recruiting interest: optimizing relevance, value, and authenticity.		
15. Providing options for recruiting interest: minimizing threats and distractions.		
16. Providing options for comprehension: activating or supplying background knowledge.		
17. Providing options for comprehension: highlighting patterns, critical features, big ideas, and relationships.		
18. Providing options for comprehension: guiding information processing, visualization, and manipulation.		
19. Providing options for comprehension: maximizing transfer and generalization.		
20. Providing options for language, mathematical expressions, and symbols: clarifying vocabulary and symbols.		
21. Providing options for language, mathematical expressions, and symbols: clarifying syntax and structure.		
22. Providing options for language, mathematical expressions, and symbols, supporting decoding text, mathematical notations, and symbols.		

23. Providing options for language, mathematical expressions, and symbols: promoting understanding across languages.		
24. Providing options for language, mathematical expressions, and symbols: illustrating through multiple media.		
25. Providing options for perception: offering ways of customizing the display of information.		
26. Providing options for perception: offering alternatives for auditory information.		
27. Providing options for perception: offering alternatives for visual information.		
28. Providing options for executive functions: guiding appropriate goal-setting.		
29. Providing options for executive functions: supporting planning and strategy development.		
30. Promoting options for executive functions: enhancing capacity for monitoring progress.		
31. Providing options for expression and communication: using multiple media for communication.		
32. Providing options for expression and communication: using multiple tools for construction and composition.		
33. Providing options for expression and communication: building fluencies with graduated levels of support for practice and performance.		
34. Providing options for physical action: varying the methods for response and navigation.		

Field Notes:

Appendix I

Teacher Lesson Plan Review Protocol

Teacher lesson plans will be reviewed using this protocol, designed to measure transfer of learning from the professional development sequence to professional practice.

Is UDL part of the lesson design?	
Present	Not present

Which UDL checkpoints are part of the lesson design?		
Multiple Means of Representation	Multiple Means of Action and Expression	Multiple Means of Engagement

To what extent did teachers make adjustments to instructional practice, based on feedback from their peers? Note: Changes to instructional practice are defined as changes in instructional methods.		
None	1 or more	2 or more

To what extent did teachers incorporate professional development concepts into their lesson design?		
None	1-2 concepts	3 or more concepts

To what extent did teachers collect research/resources to design their lesson(s)?		
None	1-2 sources	3 or more sources

Field Notes (i.e. trends in lesson design)

Appendix J

Teacher Interview Protocol

Participants will be asked the following questions. All responses will be coded and field notes will be taken during the interview. Follow up questions may be asked depending on participants' responses. I will rate participants' responses to the intervention based on the following criteria. This scale will be used to rate each participant's overall feelings about the intervention.

1	very helpful to planning	participant indicates that the intervention helped them make several adjustments to everyday instructional practice (provides 3 or more examples)
2	somewhat helpful to planning	participant indicates that the intervention helped them make several adjustments to everyday instructional practice (provides 1-2 examples)
3	neutral	it is unclear whether or not the intervention was or was not helpful
4	less helpful to planning	participant indicates that the intervention may be helpful but does not provide examples of adjustments to practice
5	not at all helpful	participant indicates that the intervention did not inform any adjustments to practice (i.e. "this had no impact on my teaching")

Participants will respond to the following questions:

1. What have been your greatest professional challenges of the school year (thus far)?

2. How would you characterize the culture of your school?

3. Over the last three years, how have your professional practices changed?

4. What do you feel you've learned as a result of professional development (over the course of the year, thus far):
   (if positive): How do you know you've been effective?
   (if negative): What could have been improved?

5. Do you feel that the lesson study process supported your professional growth as a teacher?
   (if yes) How so?
   (if no) Why not? How do you feel that it could have been improved?

6. How has lesson study changed your teaching practices (be as specific as possible)? *Note: If respondents say that it hasn't, move onto the next question.*

7. How (or has) UDL informed your professional practice?
   (if yes) Please provide specific examples.
   (if no) Why do you feel that it did not inform your practice?

8. Which principles of UDL most informed your lesson study (be as specific as possible)? *Note: If respondents say that it hasn't, move onto the next question.*

9. Do you believe that you will meet your professional practice goal this year? Why or why not?

10. What do you feel you still need to learn?

Appendix K

Teacher Learning & Cognition Survey

The following survey will be administered to teachers in December 2015 and again in March 2016. Survey respondents will be asked to identify themselves, however, all of the respondents' data will be coded.

Directions: Which of the following UDL "checkpoints" relate to your lesson study?

1	2	3	4	5
I do not know how to do this.	I need more knowledge/ coaching about how to do this..	Neutral/I have some strategies of doing this.	I am comfortable and can utilize strategies with independence.	I am so comfortable that I could model this for others.

1. Providing students with multiple means of engagement.
2. Promoting representational networks in the brain.
3. Promoting affective networks in the brain.
4. Providing students with multiple means of action and expression.
5. Promoting strategic networks in the brain.

Directions: Describe your level of comfort using the following strategies in your teaching:

1	2	3	4	5
I do not know how to do this.	I need more knowledge/ coaching about how to do this..	Neutral/I have some strategies of doing this.	I am comfortable and can utilize strategies with independence.	I am so comfortable that I could model this for others.

1. Providing students with multiple means of engagement.
2. Promoting representational networks in the brain.
3. Promoting affective networks in the brain.
4. Providing students with multiple means of action and expression.
5. Promoting strategic networks in the brain.

Directions: Which of the following UDL concepts do you wish to learn more about?

1. Providing students with multiple means of engagement.
2. Promoting representational networks in the brain.
3. Promoting affective networks in the brain.
4. Providing students with multiple means of action and expression.
5. Promoting strategic networks in the brain.

Directions: To what extent do you feel confident in your ability to implement the following math practices?

1	2	3	4	5
I do not know how to do this.	I need more knowledge/ coaching about how to do this..	Neutral/I have some strategies of doing this.	I am comfortable and can utilize strategies with independence.	I am so comfortable that I could model this for others.

1. Teachings numbers and operations using a developmental progression.
2. Teaching geometry, patterns, measurement, and data analysis using a developmental progression.
3. Using progress monitoring to ensure that math instruction builds on what each child knows.
4. Teaching children to view and describe their world mathematically.
5. Dedicating time each day to teaching math, and integrate math instruction through the school day.
6. Screening all students to identify those at risk for potential mathematical difficulties.
7. Providing interventions for students at risk.
8. Providing interventions that focus intently on in-depth treatment of whole numbers.
9. Providing explicit and systematic instruction. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.
10. Providing interventions that include instruction on solving word problems based on common underlying structures.
11. Providing interventions that include opportunities for students to work with visual representations of mathematical ideas.
12. Providing strategy-based interventions to support building fluent retrieval of basic arithmetic facts.
13. Monitoring the progress of students receiving supplemental instruction and others who are at risk.
14. Incorporating motivational strategies for students receiving tier-2 and tier-3 instruction.

Directions (pre-assessment only): What do you hope to gain through the lesson study process? In other words, what are the outcomes you hope to achieve?

(Open Text Field)

Directions (pre-assessment only): Do you believe that the UDL framework has the capacity to transform some aspect(s) of your teaching practice?

(Open Text Field)

Directions (pre-assessment only): Do you believe that lesson study has the capacity to transform some aspect(s) of your teaching practice?

(Open Text Field)

Directions (post-assessment only): Did you accomplish your intended outcomes through the lesson study process?

(Open Text Field)

Directions (post-assessment only): Did the UDL training some aspect(s) of your teaching practice?

(Open Text Field)

Directions (post-assessment only): Which UDL checkpoints have you incorporated into your teaching practice as a result of the professional development sequence? Select all that apply.

1. Providing opportunities for self regulation: promoting expectations and beliefs that optimize motivation.
2. Providing opportunities for self regulation: facilitating personal coping skills and strategies.
3. Providing opportunities for self regulation: developing self-assessment and reflection.
4. Providing opportunities for sustaining effort and persistence: heightening salience of goals and objectives.
5. Providing opportunities for sustaining effort and persistence: varying demands and resources to optimize challenge.
6. Providing opportunities for sustaining effort and persistence: fostering collaboration and community.
7. Providing opportunities for sustaining effort and persistence: increasing mastery-oriented feedback.
8. Providing opportunities for recruiting interest: optimizing individual choice and autonomy.
9. Providing options for recruiting interest: optimizing relevance, value, and authenticity.
10. Providing options for recruiting interest: minimizing threats and distractions.

11. Providing options for comprehension: activating or supplying background knowledge.
12. Providing options for comprehension: highlighting patterns, critical features, big ideas, and relationships.
13. Providing options for comprehension: guiding information processing, visualization, and manipulation.
14. Providing options for comprehension: maximizing transfer and generalization.
15. Providing options for language, mathematical expressions, and symbols: clarifying vocabulary and symbols.
16. Providing options for language, mathematical expressions, and symbols: clarifying syntax and structure.
17. Providing options for language, mathematical expressions, and symbols, supporting decoding text, mathematical notations, and symbols.
18. Providing options for language, mathematical expressions, and symbols: promoting understanding across languages.
19. Providing options for language, mathematical expressions, and symbols: illustrating through multiple media.
20. Providing options for perception: offering ways of customizing the display of information.
21. Providing options for perception: offering alternatives for auditory information.
22. Providing options for perception: offering alternatives for visual information.
23. Providing options for executive functions: guiding appropriate goal-setting.
24. Providing options for executive functions: supporting planning and strategy development.
25. Promoting options for executive functions: enhancing capacity for monitoring progress.
26. Providing options for expression and communication: using multiple media for communication.
27. Providing options for expression and communication: using multiple tools for construction and composition.
28. Providing options for expression and communication: building fluencies with graduated levels of support for practice and performance.
29. Providing options for physical action: varying the methods for response and navigation.

Directions (post-assessment only): Did lesson study transform some aspect(s) of your teaching practice?

(Open Text Field)

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CURRICULUM VITAE

Education

Ed.D. Johns Hopkins University School of Education. Mind, Brain, and Teaching (August 2016). Dissertation title: "Professional Development Effects on Teachers' Self-regulated Learning."

M.Ed. Rhode Island College. Educational Leadership (May 2010).

M.A.T. Brown University. English Education (May 2005).

B.A. ***(summa cum laude)*** **Wheaton College (MA)**. English (May 2003). Honors: Phi Beta Kappa, Dean's list all semesters, and graduated with departmental honors in English.

School Administration Experience

- **Principal**, Lilja Elementary School, Natick, MA — July 2013-Present
- **Assistant Principal**, Jordan/Jackson Elementary School, Mansfield, MA — 2010-2013

Teaching Experience

- **Instructor, Johns Hopkins University School of Education, Graduate TFA Program,** Baltimore, MD — August 2014-Present
- **Instructor, Rhode Island College**, Educational Leadership (LEAD program), Providence, RI — Fall 2016
- **Instructor, Community College of Rhode Island**, English Department, Lincoln, RI — 2005-2007
- **Teacher, Qualters Middle School,** English Language Arts, Mansfield, MA
- **Teacher, Hope High School**, Reading & Literacy Strategies, Providence, RI — 2005-2006

Professional Publications

- **Wow Ed! Center for Educational Improvement.** "Let's Dwell in Possibility: Using Brain-Based Learning for the 21st Century." — April 2015

Presentations & Speaking Engagements

- **Presenter, International STEM Education Conference.** "Making Your Space Work: Piloting Makerspaces in Elementary Education." (October 2016).
- **Presenter, Massachusetts Elementary School Principals' Association Spring Conference.** "Professional Development Effects on Teachers' Self-Regulated Learning." (May 2016).
- **Presenter, Massachusetts Elementary School Principals' Association Spring Conference.** "Let's Take This Outside: Supporting Academic, Social, and Emotional Development Through Outdoor Education." (May 2016).
- **Presenter, URI Graduate School Conference.** "Professional Development Effects on Teachers' Self-Regulated Learning." (May 2016).
- **Presenter, National Association of Elementary School Principals National Conference.** "21st Century Learning & Implications for Neuroscience on School Leadership." (June 2015).
- **Guest Speaker, Brown University Graduate School.** "Supporting Students' Executive Functioning Skills." (December 2015).
- **Presenter, SPARK**. "Supporting Your Child's Executive Functioning Skills." (December 2015).
- **Presenter, Massachusetts Computer Using Educators (MASS CUE).** "Digital Engagement: Cultivating Communities of Practice for Transformative Learning." (October 2014).
- **Presenter, SPARK.** "Implementing Mindfulness Awareness Practices in Elementary Classrooms." (October 2014).
- **Presenter, Wheaton College's Exploring Careers Panel.** (2012).
- **Guest Speaker, Rhode Island College.** "Life After LEAD." (2011 & 2012).
- **Presenter, Boston College's New Teacher Academy.** "Teacher Talk." (2008).
- **Presenter, Brown University's No Teacher Left Behind Conference.** "Networking for Novice and Expert Teachers." (2008).
- **Presenter, Rhode Island Conference on Literature for Young People.** "Incorporating Performance-Based Strategies to Teach *The House on Mango Street*." (2005).
- **Presenter, New England Organization of Human Services Education.** "Using Student Portfolios as Assessment Tools." (2001).
- **Presenter, Academic Festival at Wheaton College.** "A Virtuoso of Affectation: Oscar Wilde, Aesthetics, and the Importance of a Scandal." (2003).

Research Experience

- **Student Investigator, Professional Development Effects on Teachers' Self-Regulated Learning.** Johns Hopkins University, Baltimore, MD. (2013-2016)

- **Lead Researcher, Mindfulness Awareness Practices in Elementary Schools.** Natick Public Schools, Natick, MA. (2014-2016).
- **Project RITER (Rhode Island Teacher Education Renewal) Fellow**, Brown University, Providence, RI. (Summer 2005).
- **Steering Committee Member for Contemplative Studies Initiative**. Wheaton College, Norton, MA. (2012-Present).
- **Wheaton Research Partner.** Wheaton College, Norton, MA (2002-2003).

Relevant Committee Work

- **Participant, Rhode Island Education Innovation Cluster.** (2016).
- **Participant, Educational Leadership Articulation Performance Committee.** Rhode Island Department of Education. (2008).
- **Contributor, Massachusetts Frameworks for English Language Arts Writing Panel.** Massachusetts Department of Elementary and Secondary Education. (2006-2007).

Grants

- "**Training the Brain to Grow: Teaching Students About Motivation, Effort, Perseverance, and Achievement through Brainology."** (September 2015). Funded by the Natick Education Foundation.
- **"Making Your Space Work: Piloting Makerspaces in Elementary Education."** Collaboration with Alexandra Murtaugh, Johns Hopkins University. (January 2016). Funded by the Lilja PTO.
- **"Heart Centered Approach to Improving Social Relationships, Self-Regulation, and Academic Learning for Student with Attention Deficit Hyperactivity Disorder."** Collaboration with Christine Mason, Executive Director at Center for Educational Improvement and Bruce Wexler, Yale University. (April 2014). Unfunded.
- "**Linking with Lilja's Literary Lot."** (November 2014). Funded by the Natick Education Foundation.
- **"Nurturing School Readiness."** (November 2013). Unfunded.
- **"Lilja School Garden."** (March 2014). Funded by the Natick Education Foundation.

Active Affiliations & Memberships

- International Society for Technology & Education (ISTE)
- American Psychological Association (APA)
- American Educational Research Association (AERA)
- National Association of Elementary School Principals (NAESP)
- Massachusetts Elementary School Principals' Association (MESPA)
- Rhode Island Association of School Curriculum & Development (RI ASCD)
- Brown University Club of Rhode Island (BCRI)

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